AMATEUR WORK

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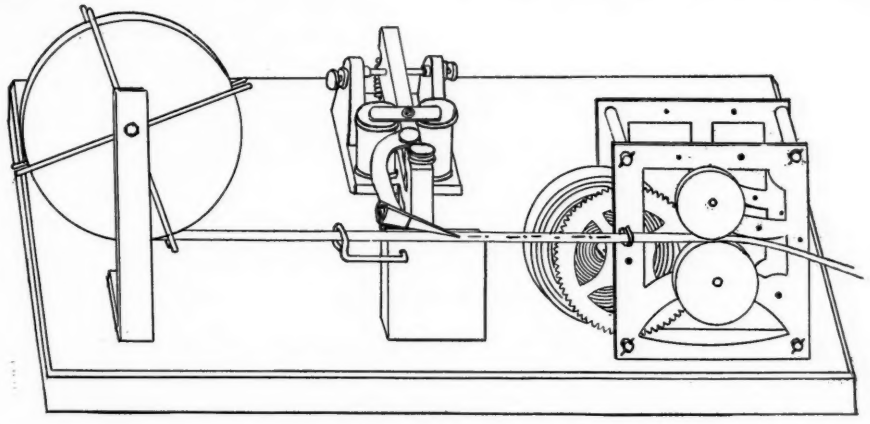
A TELEGRAPH RECORDER.

FREDERICK A. DRAPER.

Until one has acquired the ability to read telegraphic sounds by ear, some form of recording instrument is necessary to enable messages to be received. The apparatus here described is easily made at small expense, and with it the messages are legibly printed upon the moving tape and can, therefore, be read as soon as the operator has memorized the various characters.

suitable baseboard, the size being determined by that of the parts used for making the receiver.

The works of the clock can frequently be had for the asking at a jewelry store. The requirements are: a strong spring in good working order, and the train of the four gears, that on the spring shaft being the first. The escapement and alarm part are removed. The hour hand shaft



The illustration shows the general arrangement; the works from an old clock provide the mechanism for moving the tape, a common sounder is fitted with a small pen of the kind used for paper ruling machines, the point of which rests on the tape and marks it, the tape being supported under the pen by a small, smooth block of wood. The tape, the kind used in "ticker" machines to be found in stock brokers' offices, is supported by a frame and should unroll with but little friction. These parts are all arranged on a

will be found to project from about the centre, and about 1 in. above will be found the shaft for the trip of the alarm. The latter is removed and a shaft projecting about 1 in. is fitted in its place. To the hour-hand shaft and the shaft just mentioned are fitted two wooden pulleys or cylinders, that on the hour-hand shaft being the larger, and covered with a wide rubber band. The upper pulley is of a size to fit firmly against the rubber covering on the lower one, so that the tape, which passes between them, will have a firm and

even tension. A wire is bent to form a guide for the tape, and fitted to the clock frame.

For attaching the pen to the sounder, a support is made of thin, strip brass, which may be cut from the clock case, the inner end being curved to come under the check nut on the adjusting screw of the armature lever. The outer end is curved to a V shape and at an angle, so that it will hold the ruling pen firmly and at an angle sufficient to cause the ink to flow readily. A block of wood is glued to the base board under the point of the pen, to support the tape, the size being determined after the pen is in position. A wire guide for the tape is also fitted to this block, as shown in the illustration.

The bracket for the tape holder can be made by mortising the end of a piece of wood in the base board, or a 6 in. angle iron may be used, a part of one end being cut off. The tape mentioned comes in rolls 5 in. diameter, with a wooden block in the centre $1\frac{1}{8}$ in. diameter, the tape being $1\frac{1}{8}$ in. wide. Other sizes are sold by wholesale paper houses, and the parts should be made for the size of rolls most easily obtained.

To the top of the bracket fit a $\frac{1}{4}$ in. machine screw long enough to project and allow two nuts to go on the outer end after the roll holder is in place.

The roll holder is made from an ordinary spool, the flanges being cut off and the length being $\frac{1}{4}$ in. greater than the width of the tape. On one end drill four holes to receive wires about $2\frac{1}{2}$ in. long; the holes should be a driving fit for the wires. Then cut a disc the same diameter as the spool, from a piece of $\frac{1}{4}$ in. wood, first boring a hole in the centre slightly larger than the machine screw bearing. Fit four wires to this disc, the same as with the spool. The roll of tape being placed on the holder, the disc is placed outside, and after putting it on the shaft the nuts are put on, the outer one acting as the check nut to prevent the inner one from binding on the disc and spool, and so holding them in place and yet allowing them to turn freely.

When all is completed the tape is carried from the holder under the pen and between the two pulleys of the clock works, the latter wound up and, when desired, allowed to pull the tape under the pen. The illustration does not show all the gears. The fourth one projects at the side so that a trip can be fitted to it, which can be moved by an electric magnet in series with the sounder. In this way the spring can be kept constantly wound up, and the tape started by the first signal received, thus allowing a message to be recorded even if no one is present. The spring of an ordinary alarm clock will operate long enough, without rewinding, to receive quite a long message.

A CHAMBER SET.

JOHN F. ADAMS.

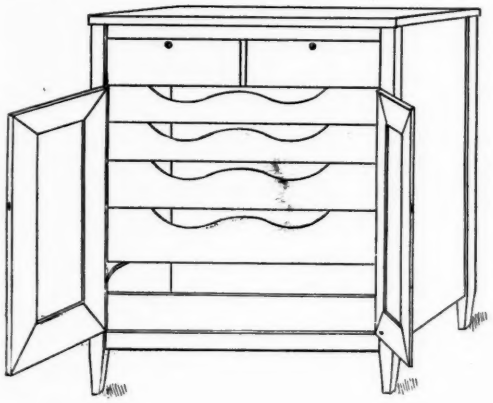
III. Chiffonier for Men.

A chiffonier, designed especially for gentlemen's use, is at present a novelty in the furniture line, but is rapidly becoming very popular, as it allows the wardrobe to be much more conveniently stored than can be done in a bureau or or chiffonier of the usual style. The one here described can easily be made by any one familiar with the use of wood working tools.

The four corner posts are $1\frac{1}{2}$ in. square and 47 in. long. Rabbets $\frac{1}{4}$ in. deep are cut for the end pieces, which are $41\frac{1}{2}$ in. long, 21 in. wide and $\frac{3}{4}$ in. thick. Because of the width the end pieces as well as the top will have to be glued up, care being used to get a good match with the grain along the joint. The top is 40 in. long, 24 in. wide and $\frac{7}{8}$ in. thick. A frame is also made of strips of birch 3 in. wide, which will measure outside, 37 in. long and $22\frac{3}{4}$ in. wide. The corners are cut out to fit around the posts; this frame fitting under the top and serving to give stiffness to the frame. The back edge is set in $\frac{1}{2}$ in. from the back of the top, the sheathing of the back being nailed thereto. A similar frame is made and put in under the two drawers at the top, and a piece of board $\frac{3}{4}$ in. thick placed between the two frames, dividing the drawers. A similar frame is

also made to go under the lower drawers.

Two narrow cross pieces go across the front, that under the top being 1½ in. wide and that at the bottom 2 in. wide; both are 28 in. long, thus giving 1 in. on each end for tenons to fit mortises cut in the posts. The frames, top ends and cross pieces being cut out and fitted, they are assembled and fastened firmly with glue and screws; the back is then sheathed with ½ in. matched sheathing.



The two top drawers are 17½ in. wide, 22¾ in. long, and 5¼ in. deep; the fronts are 6 in. deep, projecting ¾ in. below the bottom of the drawers, thus concealing the frame upon which they rest. The inner edge of this lower part is also cut away for about 4 in. in the centre to make a place for the fingers, with which to pull them open. The fronts are flush with the cross piece above.

Two panel doors are then made to fit in the front, which are 31½ in. high and 18 in. wide. The frames are made of ⅞ in. stock 3 in. wide, the mortises for the corner joints being mitred. Rabbets ⅜ in. wide and deep are cut on the inner edges for the panels, which are 26¼ in. long and 12¾ in. wide. All joints should be strongly glued and set up with clamps while drying.

The remaining drawers are all 36 in. long and 22 in. wide, other dimensions being: the two top ones 5 in. deep; the next 6 in. deep, the next 7 in. deep, and the bottom one 9 in. deep, the front board of the latter being only 5 in. wide. The runs for these drawers are made from strips ½ in. square, which are attached to either solid boards or frames placed on the insides between the posts and flat against the inside of the ends. To allow room for the runs, the sides and back of all the drawers except the top are ⅝ in. less in depth than are the front pieces. The front pieces are cut out to the curves shown, so that the contents of each drawer can be seen. The edges of these curved parts are rounded and carefully sandpapered.

The doors are hung with three brass hinges on each, a bolt fastening is put on the bottom of the left one and a lock on the right one. Locks are also put on the two upper drawers. Nothing has been said about the kind of wood used, this being left to the choice of the maker as well as the finish. In mahogany it makes a fine looking piece of furniture, this being the wood used for making the one from which this description is taken.

PATTERN MAKING FOR AMATEURS.

F. W. PUTNAM.

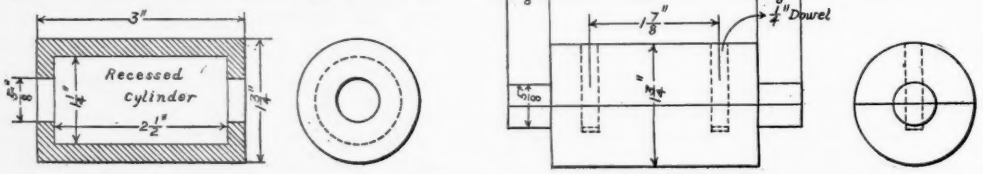
VII. Methods for Making Split Patterns, — Fillets.

A great portion of cast iron and brass work is so designed as to require the patterns to be "split". That is, made up in two pieces. In a jointed pattern the moulding is greatly facilitated by making the pattern in halves.

A casting for a recessed cylinder is given in Fig. 38, the split pattern being shown in Fig. 39. Fig. 40 shows the pattern in position in the mold, the joint between the two halves of the pattern coming at the parting line between the cope and nowell.

Two pieces of clear dry pine will be required for the pattern, each being large enough to finish 6 in. long, 2 in. in width and 1 in. in thickness. The blocks are left 1¾ in. longer than the finished pattern in order that the marks made by the head and tail centres may be removed, and also that enough surface may be left for glue, which is often

used in the ends of the blocks for holding the presses tightly together without its penetrating or reaching the surface of the pattern itself. These two pieces are to be carefully planed on the face and joint sides and should be of the same thickness. The face sides of the two blocks are the surface which form the joint and are shown in Fig. 41, where the two halves are placed face



FIGS. 38 AND 39. CASTING AND SPLIT PATTERN FOR RECESSED CYLINDER.

to face with the dowel pins (in this case, concealed dowels are shown) in place. Fig. 42 shows the blocks brought together with the outline of the required pattern drawn upon them, thus illustrating the allowances that are usually made for finishing the pattern.

The pieces should next be dowelled together, either of two general methods being used. The first method is as follows: Clamp the two pieces together with the face sides together, and from the joint side gauge a central line along the outside surface of one of the blocks, marking on this centre line the two points for the centre of the dowel holes. Fig. 39 shows these centres to be $1\frac{3}{4}$ in. apart. Bore holes with a $\frac{1}{4}$ in. auger bit through the top piece and $\frac{3}{8}$ in. into the bottom piece. Cut two dowel pieces long enough to extend $\frac{5}{16}$ in. into the bottom pieces, and glue these dowels into the top pieces. The projecting pieces are cut purposely $\frac{1}{16}$ in. less in length than the depth of the dowel hole, and are to be tapered so as to enter and leave the hole easily.

These projecting pins should be carefully tapered or they will cause the molder a great deal of annoyance, and the resulting castings may be imperfect. Many workmen make the pins project a distance considerably larger than its diameter. A short pin, however, governs the position just as well as a long one and is also less liable to stick in the loose half of the pattern, so that for small or medium size patterns it will be found advisable to let the projecting ends stand out from $\frac{1}{16}$ to $\frac{3}{16}$ in. of the large part of the hole, the remainder being tapered off so as to make sure the pin can be freed easily. The dowel pin should be fairly large in diameter, for the larger the pin the longer it will remain free from warping. It is especially necessary that the dowel pin be absolutely round at the part that fits the hole.

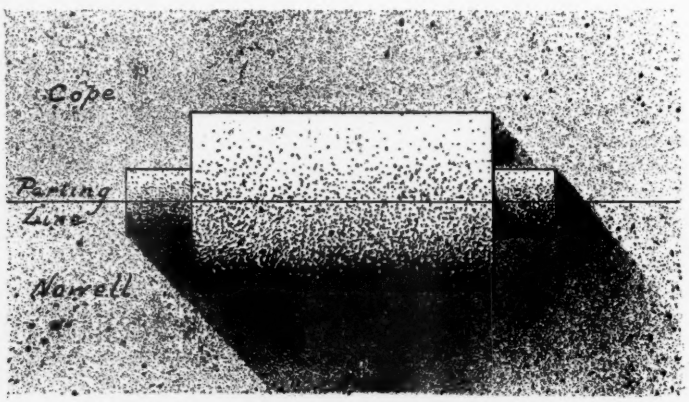


FIG. 40. SPLIT PATTERN IN MOLD.

If these precautions are neglected castings will probably result in which the halves will not match. The pins should not fit tight in the loose half of the pattern, as then the halves will not separate when molded.

It frequently happens that it is necessary to keep the outside surface of the pattern unbroken, and also there are many cases in large work where the holes would require boring so deep and the pins made so long that the second method is made use of as shown in Fig. 43 and Fig. 41. In such cases the centres of the holes must be very carefully located and are usually laid out in one of the following ways:

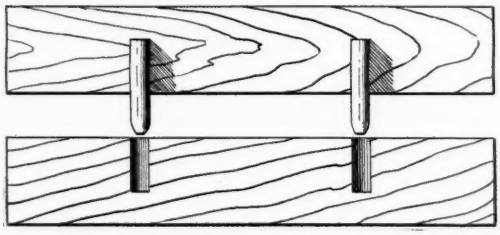


FIG. 41. JOINT FOR SPLIT PATTERN.

Place the pieces side by side with the joint sides touching and the ends even. Make two notches at the joint the required distance apart and, after separating the pieces, square very fine lines with a knife across the face sides of the two blocks. Next set a guage at half the width of the pieces and mark the intersecting lines, thus giving the required centres.

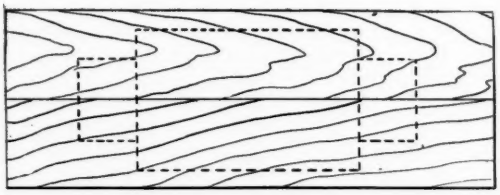


FIG. 42. MARKING OUT SPLIT PATTERN.

A second method is to locate the holes by laying two small wire nails between the pieces and then tapping the other piece with a hammer or mallet. The heads of the nails will make impressions in each piece, which will indicate the centre of the holes to be bored.

A third method is to provide some ordinary lead shot and make the shallow holes with a brad awl slightly less in diameter than the shot. When pins are to be inserted, place the shot in the hole so that they project beyond the surface, and then proceed to apply a little pressure to the two locks.

It is often found necessary to place the dowel pins at uneven distances from the ends of the pattern, one being nearer the centre than the other, so that the molder can instantly put the two parts of the pattern together without having to turn them half round the opposite way.

After gluing and inserting the pins the two halves of the pattern must be firmly fastened together in such a manner that they can be turned as one piece. There are four ways of doing this and a brief description of each follows:

1st method. The end surfaces for a breadth of $\frac{3}{8}$ in. to $\frac{1}{2}$ in. are brushed with hot glue, after which

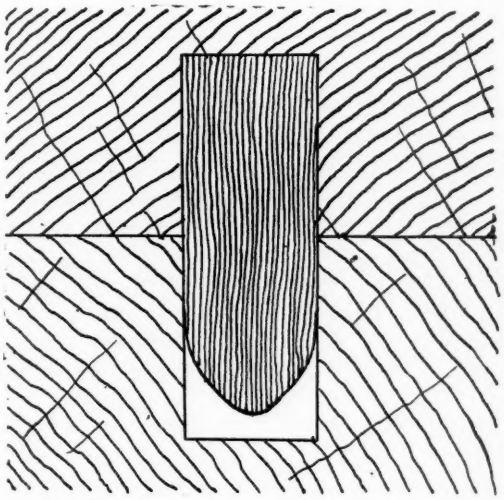


FIG. 43. JOINT FOR SPLIT PATTERN.

the pieces are firmly clamped together until the glue is thoroughly hard. Frequently a piece of newspaper is glued to each piece and glue placed between the two pieces at the ends only. It is not necessary that the newspapers cover the entire surface of the pattern, strips being glued simply between the ends. If this method has been followed the pattern, after being finished, may be separated by inserting a knife blade or chisel between them, leaving a strip of paper on each half. When patterns are secured by glue and paper, care must be taken in turning to avoid catching tools, because of the natural tendency of glued pieces to fly apart owing to the great speed at which they revolve in the lathe. The ends should be turned down to about $\frac{3}{8}$ in. diameter and then

sawed off and finished with a knife, chisel or file.

2nd method. It frequently happens that the pattern maker cannot wait for the glue to harden and set, or it may be, if the pattern is a large one, that it would be unsafe to trust entirely to glue, in which case wood screws are often used at the ends, as shown in Fig. 44.

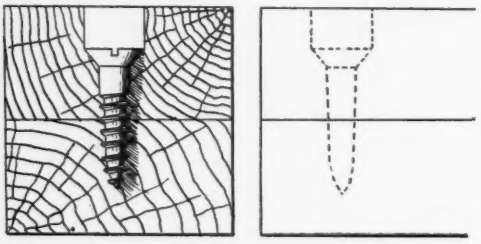


FIG. 44. USE OF SCREWS IN SPLIT PATTERN

3d method. For small and medium sized patterns corrugated steel fasteners are often used for fastening two blocks of wood together. They are made of the best cast steel and are so simple, effective and easily applied as to be very serviceable for a great variety of pattern work.

4th method. Dogs are also frequently used for this work. They are a kind of square staple made of steel, sharp pointed, two of them being driven in each end. While they are very handy both on large and small work, they are rather clumsy, and the use of screws or fasteners is preferable.

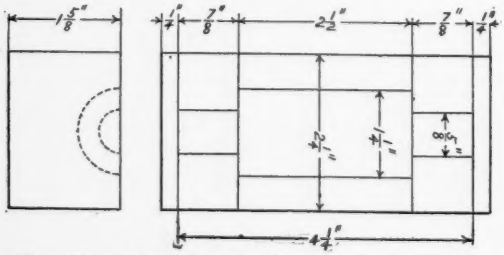
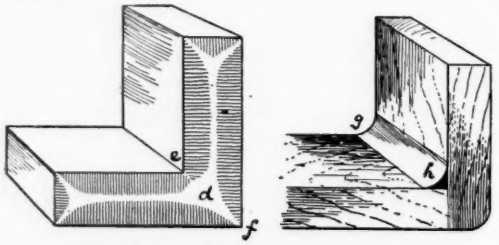


FIG. 45. CORE BOX FOR RECESSED CYLINDER.

Having fastened our pieces together by one of of the above methods, the block is next placed in the lathe and turned as though it were solid. Great care should be taken to have the centre spurs exactly in the joint; if any error is not corrected one half of the finished pattern will be larger than the other. To remedy any error, tap the pattern lightly with a hammer in the required direction, immediately screwing up the tail centre a trifle tighter so as to hold the pattern in the new position. An error can be detected provided the blocks were made the same thickness, by taking a light gauge cut across the block and then carefully comparing the width of the flat surface left on each half.



FIGS. 46A AND B. USE OF FILLETS.

Do not forget the necessary allowances for draft, shrinkage and finish. The draft in the core print ends, *A*, Fig. 39, is finished with a file and sandpaper after the extra stock on the ends has been cut off.

The half core box for this pattern is shown in Fig. 43. The two parts, *B*, are of the same size and should be cut from a single block of wood long enough to allow for finishing to the required length of each piece after the half hollow has been cut out. It will be noticed that the end walls as well as the shell of the casting, Fig. 38, are only

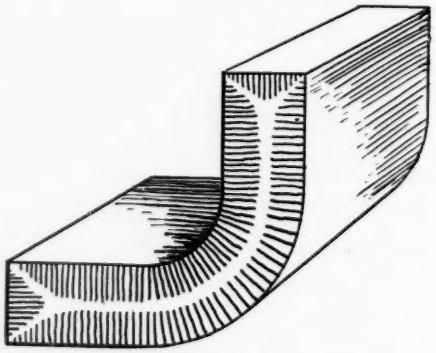


FIG. 46C. ROUNDED CORNER.

$\frac{1}{4}$ in. thick, so that the centre block of the core box, Fig. 45, must be made very carefully to the size required. No further directions should be necessary for making the core box, as the work is done exactly in the same way as explained in previous exercises.

In a previous chapter I took up very briefly the

necessity for fillets. Sharp corners on the inside of a pattern form sharp corners of round when molding and thus give the molder a vast amount of trouble. Sharp corners not only detract from the appearance of the casting, but also weaken the casting, as clearly shown at Fig. 46. At *A* is shown a casting with a sharp corner. As iron hardens crystals seem to form in such a way that their lines of strength, as they are called, are perpendicular to the surfaces, as shown by the lines in this figure. This leaves, of course, an open space or, rather, a space of irregular crystalization at *d*, and so the casting is liable to break along the line. For overcoming this difficulty a *fillet* is generally placed on the inside corner, as shown at *B*, Fig. 46, *h* being the fillet. It will be noticed that the outside corner of the pattern is also somewhat rounded.

At *c*, Fig. 46, is shown a casting for a pattern having a carefully rounded corner, there being now no space of irregular crystalization, as occurred at *d* in Fig. 46, *A*.

PHOTOGRAPHY.

PRINTING IN PLATINUM.

W. M'ARTHUR.

II. Developing the Print.

The developer may well be made up in bulk, as it keeps well. A special developer known as D salts is sold by the Platinotype Company, and gives admirable results, but neutral potassium oxalate works equally well, giving a good rich black which is preferred by many workers to the bluish black given by the D salts. As full particulars for use are issued with each packet of the D salts, it is unnecessary to detail them here.

In making up the potassium oxalate developer four ounces of the crystals are dissolved in forty ounces of water. A convenient way of making the solution is to tie the crystals in a piece of muslin and to suspend the bag so formed just below the surface of the water in a jug. Solution then takes place quickly, as the heavy liquid sinks to the bottom. If tap water is used the lime salts present in it will react with the oxalate and cause the solution to be opalescent. Except that it is more convenient to work with a clear solution this milkiness does no harm, but by allowing the solution to stand for a few hours the precipitate will settle and the clear liquid may be decanted into a suitable bottle or jar. From this stock solution sufficient for use may be taken and kept in a smaller bottle and used until it becomes loaded with iron salts from the paper, when it should be discarded. This is a better plan than to return the used solution to the stock bottle. If the potassium oxalate is bought from a reputable dealer it will be in a suitable condition for use, but if strongly alkaline it must be neutralized by the addition of a little of a saturated solution of oxalic acid. Slight acidity in the bath does not impair its action but tends to give cold black. Very slight alkalinity, which may be secured if wanted by the addition of potassium carbonate, gives brownish blacks. The developer is best used at a temperature of from 60 to 65 deg. Fahr. The clearing bath is made by adding one part of good hydrochloric acid to sixty parts of water. The very common variety known as spirits of salts should not be employed. If many prints are to be developed a large jugful of the clearing bath should be made up, as it must not be used sparingly or the iron will be left in the paper and become yellow in time.

A dish a size or two larger than the prints to be developed should have the developer poured into it to the depth of half an inch or more, and the same with the clearing bath.

The usual instructions are to float the paper face downwards on the developer, but in unaccustomed hands there is a tendency for air bells to form in this method of working. A simpler plan, and one to which there is no objection, is to hold the paper by one end face upwards and to

slide it under the solution. If air bells form they are at once seen, and may be broken by shaking the dish. The moment the developer touches the paper development begins and is concluded in a very few minutes. It is desirable to expose the paper so that it may be left in the developer till the action is complete, though slightly over-exposed prints may be saved by removing them from the developer at an early stage.

After the print has been some thirty seconds in the developer, it will be seen that no further action takes place. It should then be removed to the clearing bath in which the yellow coloration is removed. At least three such baths should be used, and the prints should remain in each for five minutes, care being taken to prevent them from sticking together. If any trace of yellow color is seen in the last clearing bath, as may be the case if a number of prints are manipulated at one time, a fourth and even a fifth bath must be given. After clearing, the prints must be transferred to cold water and washed for twenty minutes, when they may be dried by laying them face downward on blotting paper or a clean towel.

To return to the trial strip, if the image has been printed to the correct depth, the remaining strips may be printed upon by way of practice, either from the same or other negatives, using the undeveloped piece that was cut off as a guide. It is, however, hardly likely that the first trial will be exactly right, or, if it is, that the success can be repeated with certainty until a little experience has been gained. It is well to select some point of detail in the lighter half-tone and to watch for the appearance of it when printing. The eye will soon become accustomed to the appearance of correctly exposed prints, and when that point is reached there is absolutely nothing more to learn.

I have said that prints that have been slightly over-exposed may be saved by removing them from the developer before the action is quite complete, when they should at once be placed in the clearing bath. I mention this, not to encourage carelessness in exposing, but simply because the power of correcting faulty exposure is frequently referred to, and the instructions might appear incomplete without it. When it is found that the exposure has been carried too far in a batch of prints and the first has been over-developed, the next should be slid under the developer and withdrawn as soon as it is completely wetted. The print should be held in the hand or laid on a sheet of glass until all the detail in the high lights that is required appears, and then placed in the clearing bath. Prints treated in this manner are seldom so bright as when correctly exposed and developed, and are frequently mealy in appearance.

It is very frequently stated that under-exposed prints may be saved by warming the developer, and it is so to a certain, though very limited, extent. The aim of the printer should be to expose the prints to the correct stage, when development becomes automatic. When a number of prints have been developed the developer becomes loaded with iron salts and in time will give faulty prints. Should the slightest falling off in quality be noted the bath should be discarded and a fresh portion taken into use. A bath that is too weak will cause platinum to float off the surface of the paper, and if anything of the sort is noticed the bath should be strengthened. After the developer has been used it is better stored in the dark.

Printing in damp weather, or any cause that leads to the paper becoming moist will, in the early stages, tend to muddy looking prints, and prolonged printing in dull rainy weather will lead to the image developing out in an imperfect manner during printing. Usually only the shadows blacken while printing in such cases; the half-tones will develop out when the print is placed in the developer, but the image will be unsatisfactory. Prints from dense negatives should never be attempted on dull damp days, nor begun so late in the afternoon that the exposure must be carried over to the next morning.

When a number of prints are to be made from one negative, it will be found convenient to develop each print as it is made, but when a number of negatives are being printed from, there may be no time for development till the whole batch is completed. In such a case, each print as it is removed from the printing frame should be placed in the storage tube, where it is safe from moisture and may afterwards be developed at any convenient time. On no account should the prints be placed in a drawer or between the pages of a book, as is commonly

and harmlessly done with prints on silver paper. If a piece of paper is too large for a print it should not be torn across, but cut away with a pair of scissors. In tearing it there is always a possibility of particles of the platinum being thrown from the torn part on to the surface of the paper and causing black spots if they remain *in situ*, or white spots should they be brushed off after printing. The plainotype paper recently brought out by the Kodak Company is free from this defect.

A method of local development with glycerine which gives admirable results in the hands of a worker accustomed to use the brush has been much practised of late years. The iron and platinum salts are not soluble in glycerine, which may be brushed over the surface of the print without injury to it. On the application of the developer, also without a brush, it is to a certain extent diluted with the glycerine in the paper, and development takes place less rapidly than in the ordinary manner, thus giving time for the photographer to watch the growth of the image. Development may be still further delayed by adding a proportion of glycerine to the developer.

The print is exposed in the ordinary way, and having been laid on a sheet of glass, the glycerine is brushed well into the paper. It is well to have a finished print side by side with it for reference. Two or three cups containing ordinary developer, developer diluted with glycerine, and plain glycerine are required, together with a supply of camel-hair or sable brushes in various sizes. A brush charged with neat developer is applied to the parts which are to be brought out in full strength and while they are growing in vigor the dilute developer is applied to the surrounding detail which is only required to appear in a light sketchy manner. The edges may be softened or vignetted off by the use of a brush dipped in glycerine. As soon as the desired effect is obtained, the print is immersed in the clearing bath in which the undeveloped parts of the image disappear. The method is one which can only be successfully worked by a person who knows exactly what he wants and who has some training in the use of a brush.

I have said that while the D salts give a bluish black image, that obtained with potassium oxalate tends to give brownish blacks, as does warming the developer in the case of slightly underexposed prints. The addition of a small quantity of a saturated solution of mercuric chloride to the developer gives tones ranging from a brownish black to a yellowish umber tint. The exact proportion of mercuric chloride to be employed to give certain tints is best found by experiment, the larger the proportions of the mercuric salt the warmer the tone.

When warm tones are required it is, however, more satisfactory to employ the sepia paper. The developer is compounded by adding to each ounce of a solution made by dissolving six ounces of potassium oxalic acid in fifty-four ounces of water, one or two drams of a special solution supplied by the company for the purpose. An alternate developer is made by taking ten parts of the potassium oxalate solution just mentioned and adding one part of a saturated solution of oxalic acid. The developer is to be used at a temperature of 150 or 160 deg. Fahr. An enamelled iron dish is commonly recommended, as it may be placed over a gas ring without fear of breaking. As, however, the enamel quickly cracks, exposing the iron and ruining the developer and prints, it is better to use a granitine dish and to keep it and the solution up to the proper temperature in a water bath or on a sand bath. The manipulation and clearing of the prints are precisely the same as with black paper, but greater care must be taken to preserve the paper from the action of light, and in a general way the process lacks the sweet simplicity of the black paper.

The black paper is sold in three grades; AA, a paper of medium thickness and with a smooth surface; BB, a smooth, thick paper; and CC, a rough surface, thick paper suitable for large work. It is also supplied in grades known as A, B, and C. These are for the hot bath process, an older type with which we are not at present concerned, and S signifies the sepia paper.

Prints are mounted in exactly the same way as a photograph on other printing papers. Starch paste is best for the purpose, and a gelatine mountant should not be used except with the thick paper. As the paper does not curl up in the same manner as geletino-chloride and collodio-chloride papers, there is no necessity to mount them at all except when they are to be

framed. A margin which serves the purpose of the mount in isolating the image from its surroundings is obtained by covering the negative with a mask cut to show just as much of the image as is wanted, and then printing on a sheet of paper just large enough to allow sufficient white round the image. Prints on thick paper, either with rough or smooth surface, so treated are in the best condition for storage in a portfolio, and are more pleasant to handle than when pasted on a heavy mount.

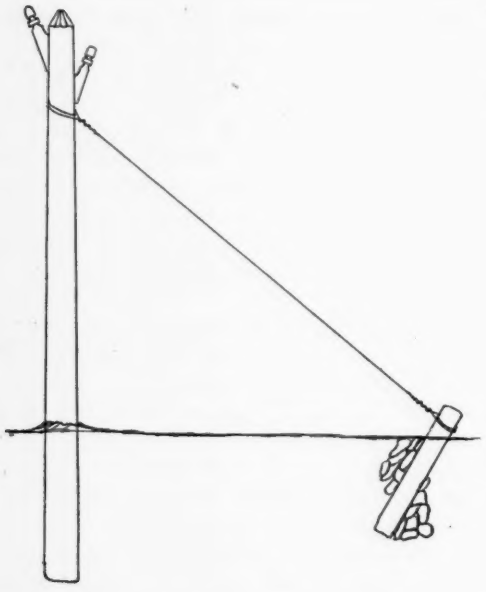
The instructions I have given in detail necessarily occupy a considerable amount of space, but the manipulations are actually most simple. Once the worker has learned to judge when the image is correctly exposed, it is almost impossible for him to go wrong. After a few attempts he will endorse the statement I have made, that the process is at once the simplest and the most economical of all.—*Photography.*

TELEPHONE CIRCUITS AND WIRING.

ARTHUR H. BELL.

IV. Putting up the Line.

In the previous chapters a description of apparatus suitable for operation over a considerable distance. The next matter of interest is the construction of a pole line to carry the two conductors from station to station. It is difficult to give specific instructions for such work because of the different conditions to be met with in various sections of the country, especially as regards soil and climate. But a practical understanding may be obtained from a description of the methods usually followed.



Permanent right of way must be secured in writing from town and citizens for every pole and for the wires and attachments placed thereon, and for the privilege of placing wires and fixtures upon the roofs of disinterested parties. The line should be surveyed as straight as possible, avoiding lengthy curves and wooded sections. One hundred and fifty feet between poles is a fair distance, providing the poles are of a length of twenty to twenty-five feet and set at least about five feet in the ground. On a two wire pole there is no need of cross arms, as insulators may be fastened to the poles, as shown in Fig. 9. On highways, where the wires are to cross from one side to the other, the crossing should be made at an angle of forty-five degrees, and poles should be all of twenty feet above ground, and the sag of the wire should be over eighteen feet from the ground. It may be well to ascertain from town authorities just what rules obtain in the construction of overhead wires. The stoutest poles should be reserved for corners and bends in the road. The top of each pole should be pointed (roofed) and painted. Poles do not require to be set so deep in rocky soil as in mellow earth, in fact, a pole of twenty-five feet length may be firmly set in three feet of rock formation.

In digging post holes it is advisable to dig them large enough to permit the poles to enter readily and to permit tamping. After the pole is in po-

sition the earth should be returned a little at a time and tamped firmly on all sides with a log or heavy device designed for the purpose, and the gravel remaining after filling should be evenly banked about the pole. At all corners and curves special attention must be devoted to anchor guys arranged to support the pole in time of storm. Often times the guy wire may be conveniently fastened to a nearby tree trunk or to a stout, low branch, if the tree is of considerable size. But the most complete way is the burying of a large log or other anchoring surface to which may be attached a heavy guy wire. Permission should be secured for the trimming of tree branches likely to strike against the wires, due calculation being made for the "drop" of wet foliage and snow laden branches.

The line wires may be No. 14 copper for very short lines and No. 12 for longer lines. Galvanized iron wire is often used and will answer very well for private line work. Particular attention must be paid by the amateur lineman to foreign wires along the path of his line. The services of experienced linemen will be required where electric light and power wires are to be passed, and under no circumstances should the inexperienced reader attempt to cross such wires alone and unaided by experienced help. Wires from pole to pole should not be stretched taut, but should be permitted to sag several inches.

In tying line wires to insulators the line wire should never be wound round the insulator but fitted into the channel provided in the knob and secured in place by a piece of strong annealed iron tie wire, one end of which passes over the line wire and is twisted in five or six turns, and the other end passing under the line and likewise turned. This makes a secure hold. A great deal of information that cannot be gleaned from publications will be noted should the amateur arrange to meet a construction gang during its new construction work along the road. Neatness in all things is a foremost requisite, and the amateur should arrange his poles perfectly as regards allignment and sag of line, so that his work will in no way become an eyesore in a community.

A considerable profit on capital invested could be made by two or more enterprisin amateurs in he operation of a private line between a village centre and the railway station, as in many places the railway borders the outskirts of the settlement, and ten cents is but a small consideration for sending a message of twenty-five words or so instead of a half-hour's drive in all kinds of weather to the freight depot, county store or post-office. If properly constructed such a line need never be out of repair during its first year of existence, and the annual expense of maintenance will be principally in station batteries and possibly a receiver cord or two.

This is a matter that should appeal to scores of readers whose home environments will permit a successful carrying out of such a scheme, and numerous opportunities for such lines are to be found in all sections of this country.

An electro-mechanical governor for steam-electric plants invented by M. Routin of Lyons, consists of a solenoid, magnetized by a few series turns, and a coil which is in shunt with the generator. The magneto-motive forces of the two windings are opposed, that of the shunt coil, however, predominating in normal conditions. The field switch, the valve mechanism, and a rheostat in series with the shunt coil of the solenoid, are mechanically connected to the armature of the solenoid. The last named switch performs the function of securing the predominance of the shunt-coil of the solenoid for any position of the latter's armature. Assuming additional load to be put on the generator, the armature of the solenoid will drop a certain distance, because the increased magneto-motive force of the series winding of the solenoid will, by more nearly balancing that of the shunt coil, diminish the strength of the electro-magnet. In falling, the armature will have acted upon the valve gear, at the same time cutting out resistance from the field circuit of the generator as well as from the circuit of the shunt coil of the solenoid. If the load is taken off, the action is reversed and the armature is drawn higher up into the solenoid, and if a short circuit takes place the series coil largely predominates, the armature is drawn right up and the steam is shut off. If the fuse blows into the generator circuit, the same thing occurs, the shunt coil now being responsible for this.

The Japanese explosive, Shimose, has been said to be more powerful than either dynamite or guncotton, Shimose does not explode on percussion, or by fire, and is not injured by wetting. When it is exploded, by a charge of fulminite, it tears a hole greater than would result from the use of a similar quantity of dynamite, and, unlike that substance, its force is equally exerted in all directions.

HANDY HINTS FOR AMATEURS.

Contributions are solicited for this department, and for each accepted article the sender will be given the choice of any one-subscription premium from our premium offers.

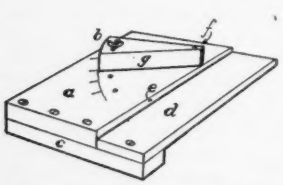
BENCH TRIMMER AND SAW BLOCK.

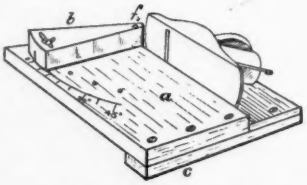
R. G. GRISWOLD.

One of the handiest devices for use in the amateur's shop is a small bench trimmer, such as is shown in Fig. 1. It will repay one a hundred times the time taken to make it well. The sliding knife is simply a small block plane, working on its side.

The base, *a*, should be made of apple or maple, well dried or seasoned and dressed perfectly flat. The edge, *e*, is planed and perfectly straight. A

Fig 1.





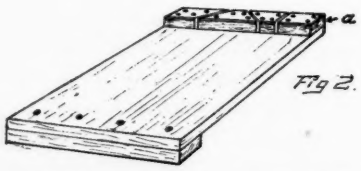


Fig 2.

piece, *d*, is then glued to it so that an edge or shoulder is left at *e* just the thickness of the side of the plane. The blade will then cut to the bottom of the piece. The surface of *a* and *d* must be truly parallel. They are glued as a whole to the bottom of *e* and four screws are put in to prevent the thrust of the plane knocking it off. This bottom also acts as a stop against the edge of the bench.

The block, *b*, is also made of maple or apple, is pivoted on a $\frac{3}{8}$ in. pin at *f*, which passes through a snug hole in *a* and is riveted to a $\frac{1}{8}$ in. plate underneath, the latter being securely fastened to *a* with four screws. The hole in *b* must also fit this pin very snugly. At the other end a circular slot encompasses a thumb screw which engages with holes in *a* so that *b* can be clamped in any position desired. The face, *g*, must stand at a true right angle with surface, *a*.

A vertical line is then scratched with a fine point on the end of *b* and by the aid of a protractor placed against the face of the plane when the latter is square against the edge, *e*, several divisions are scratched in the base, *a*, indicating angles of 90°, 60°, 45°, and 30°, or any other intermediate angles desired. These scratches are then filled with a black wax or other pigment and these settings are afterwards quickly made.

The pivoted end of *b* should just touch the bit as it passes, and this will give a support to the wood so that the bit will not break it. The piece is held against *b* with the thumb of the left hand while the plane is moved to and fro with the right. Exceedingly good work may be done with this trimmer and the joints made by it will fit nicely providing the device has been well made.

In Fig. 2 is shown a saw block which may set on the end of the bench. It is very handy when small blocks or strips are to be cut off at either 90° or 45°. The strip, *a*, which is made of maple, is glued to the base. Then a $\frac{1}{16}$ in. brass strip two inches wide is cut into pieces, as shown, so that the angles are exactly 90° and 45° with the facing edge. These are then screwed down with flat head screws and form guides for the thin back saw, whose thickness determines the width of the slots. These brass plates form guides that do not readily wear out, and the device really forms a fair mitre box but is quicker and less in the road. The block, *a*, may be made any height, but $1\frac{1}{2}$ in. has been found to be a very convenient height, as pieces any thicker than 1 in. had best be cut in a mitre box.

The man who does only what he gets paid for, gets paid for only what he does.

SAILING RULES FOR YACHTS.

CARL H. CLARK.

Before stating the rules certain definitions of the terms used are necessary. A boat is on the *starboard tack* when she has the wind on the starboard (right) side, and is on the *port tack* when she has the wind on the port (left) side.

A boat is *close hauled* when she has her sails trimmed in closely, and is sailing as closely as possible to the direction from which the wind is blowing. A boat is *running free* when she has the wind nearly aft, and is sailing with the wind, and in nearly the same direction, with the main boom at about a right angle with the hull. A boat is *reaching* when she has the wind about abeam, and the boom at an angle of about 45° with the hull.

The rules for avoiding collision between sailing yachts are as follows:—

A yacht which is close hauled on either the port or starboard tack has the right of way over one which is running free. A yacht which is sailing before the wind can easily change her course in any direction, while one which is close hauled cannot alter her course without loss to herself. A boat which is running free must keep clear of every other boat.

A boat which is close hauled on the starboard tack has the right of way over a boat close hauled on the port tack, and also over a boat which is running free. When two boats are running free or "reaching" on opposite tacks, the boat with the wind on the starboard side has the right of way over the other. If they are reaching on the same tack, the boat to leeward, or farthest from the point from which the wind is blowing, has the right of way, and the windward boat, or the one nearest the wind must keep clear. If, however, the windward boat was in danger of going ashore, the other must give way upon being requested. If they are running directly before the wind, with main booms slacked well off, the boat which has hers over the port side is virtually on the starboard tack and has the right of way.

When one boat is overtaking another the overtaking boat must keep clear. The overtaken boat must not, however, change her course after any part of the overtaking boat overlaps any part of her hull or rigging. A sailing vessel or yacht should have the right of way over a steamer or launch. It must be borne in mind, as in the rules for launches, that these rules are for guidance alone, and do not give the boat having the right of way any excuse for doing damage to an offending boat. It is also unwise for a small boat to attempt to enforce her right of way over a large boat; the small boat, being more easily handled, would best keep clear.

When sailing in a fog, a sharp lookout is kept, and the fog horn sounded:— When on the starboard tack, one blast at short intervals; when on the port tack, two successive blasts, and when running free, three successive blast. For night sailing the same lights, red on the port side and green on the starboard, may be carried, as described in the first chapter; no white light, however is carried. The same rules for judging of the position of an approaching boat apply as before, and right of way given as in sailing by day.

M. Verneuil has discovered the method of producing the ruby artificially by melting a mixture of alumina and oxide of chrome at a constant temperature of several thousand degrees, and in layers superposed from the outside to the inside, in order to prevent the production of cracks in the crystalline mass. The eminent chemist has succeeded in creating a ruby weighing about 2,500 grams and having a commercial value of about 3,000 francs. For securing the extreme temperature indispensible for the success of this operation tion, M. Verneuil had recourse to a vertical oxhydrogen blowpipe, the flame of which was directed from above downward. The hardness of the stone was secured by an energetic tempering, suddenly suspending the action of the blowpipe. The ruby of M. Verneuil has admirable fluorescence, on account of its great purity. It possesses all the physical properties of the natural ruby, and like the natural ruby, can be cut and receive a very beautiful polish.

AMATEUR WORK.

DRAPER PUBLISHING CO., Publishers,

88 Broad St., Room 522, Boston, Mass.

A Monthly Magazine of the Useful Arts and Sciences. Published on the first of each month for the benefit and instruction of the amateur worker.

Subscription rates for the United States, Canada, Mexico, Cuba, Porto Rico, $1.00 per year.

Single copies of back numbers, 10 cents each.

TO ADVERTISERS.

New advertisments, or changes, intended for a particular issue, must be received at this office on or before the 10th of the previous month.

Entered at the Post Office, Boston, as second class mail matter, Jan. 14, 1902.

SEPTEMBER, 1904.

Note the new address, 88 Broad St., Room 522,

In the office of a large manufacturing concern the editor was recently shown a letter in which the writer made application for a chance to learn the machinist's trade. The writing was poor, misspelled words abounded, and the grammatical construction was bad. This from a young man 17 years of age, who stated he had received a grammar school education.

The applicant did not receive the position, the refusal to give even a trial being based on the idea that anyone who cared so little about his ability to write a short business letter upon such an important subject, would in all probability not possess those qualities required to make a good mechanic. If the young men of today are to achieve success it can only be through a mastery of those things considered necessary for even the most unimportant positions and continued work and study until thorough knowledge is acquired of all that appertains to the work in hand or likely to be attempted.

In response to numerous requests from our readers, a book department will be opened in connection with this magazine, and we are now making arrangements to carry a stock of the more important and desirable books upon technical subjects. Any book published in the English language will be obtained, upon order, at the lowest market price consistent with the conditions required for obtaining it. A list of those thought most desirable for our readers will be published at an early date. If the price of a book is not known by the purchaser, remit the amount thought necessary, together with postage, and any excess will be returned.

BOOKS RECEIVED.

THE MECHANICAL ARTS SIMPLIFIED. B. B. Dixon. Laird & Lee, Chicago, Ill. 8½x6 in; 497 pp. Flexible leather covers, $2.50; cloth, $1.50.

A mechanic, be he amateur or professional, cannot collect too much in the way of usable data, formulas, etc. This book contains a large number of tables, rules, formulas, as well as much general information of a usable nature, and will be found of value by all mechanics and electricians.

MODERN ELECTRICITY. James Henry, M. E. and Karel J. Hora, M. Sc. Laird & Lee, Chicago, Ill. 6½ x 5 in: 355 pp. Full leather, $1.50; cloth, $1.00.

While there are a number of books covering much the same ground as does this one, the different ways used by authors for presenting a subject give to each an appropriate value. In this one every effort has been made to simplify the expressions, without sacrificing the clearness or accuracy, so that the apprentice and artisan will be able to gain a complete knowledge of the fundamental principles and applications of electricity. The work will be found practical and accurate.

PRACTICAL POINTS. John S. Farnum, M. E. Laird & Lee, Chicago, Ill. 6x4½ in. 192 pp. Cloth. $1.00

This is a handbook for engineers and mechanics, arranged in catechism form, giving questions aud answers on practical subjects connected with boilers, engines and their parts and fittings; railroad and train signals, etc., together with much general matter connected therewith. The purchase of this and similar books is cordially commended.

VACATION PHOTOGRAPHY. No. 62 Photo-Miniature. Tennant & Ward, New York. 25 cents.

It is almost needless to say that anything published in this series is valuable to the photographer. This is no exception, and contains many practical pointers for those about to go a vacationing. Money spent in preliminary study upon this subject means a greater saving in supplies, to say nothing of the better work resulting.

DESIGN FOR A LIGHT GASOLENE CAR.

J. C. BROCKSMITH. M. E.

Reprinted by Special Arrangement with the American Electrician.

The accompanying working drawings illustrate a type of gasolene automobile which is about as light and simple in construction as such a machine can be made consistent with the reach of the amateur builder and automobile enthusiast. The well-known arrangement of "motor in front, sliding gear transmission, and bevel gear drive" has been adopted as representing the best practice for light cars. Fig. 1 is a side elevation of the complete machine, which shows the general arrangement and appearance of the car.

The motor is a two-cylinder vertical machine of the two-stroke cycle type; it is air cooled and located under a well ventilated bonnet in front. The motor has an output of 6 horse power at the normal speed of 750 r. p. m. The power is transmitted through a cone clutch in the fly-wheel to the transmission gear which provides forward speeds of 6, 12, and 25 miles an hour and one reverse speed of 6 miles an hour, all at the normal motor speed of 750 r. p. m. It will be understood, however, that any intermediate speed can be obtained by the usual methods of shifting the spark and throttle control. The rear axle is driven through a universal joint and bevel gear, the latter being enclosed in the same case which contains the differential gear.

Steering is effected by means of a hand-wheel operating a screw and nut and is of the "irreversable" type; that is, no inequalities in the road can work back through the steering linkage and produce a motion of the hand-wheel. Upon the steering column are also mounted the spark and throttle levers, by means of which the speed of the motor is controlled. The machine is further controlled by means of the clutch release and brake pedals which are seen protruding above the inclined footboard. The gear is changed by means of the lever shown alongside the seat on the right-hand side. When changing from one gear to the next the clutch pedal must, of course, first be depressed, thus disengaging the motor from the transmission, so that no power is passing through the gears and they can be brought into mesh without danger of stripping the teeth.

The brake acts on the secondary shaft of the change gear, and being geared up to the rear axle in the ratio of 4 to 1, a very powerful breaking effect is obtained with a moderate size of brake drum and a comparatively light pressure by the brake.

The gasolene tank is located directly under the seat and is filled through the cap shown in the top, which can be readily got at by removing the seat cushion.

The wood work of the seat is of the simplest possible description, only straight boards being used; the curved surfaces usually seen on automobile bodies would probably be out of the question for anyone who wished to construct the woodwork himself.

The body is hung on three springs, a semi-elliptic spring being used in front, while the rear springs are full elliptic. The wheels are 28 in. in diameter, have wooden spokes and are equipped with 3-in. detachable pneumatic tires. Fig. 3 is an end elevation of the complete machine, which brings out a number of dimensions and points of construction not clearly indicated in Figs. 1 and 2. The front spring is a 38-in. 5-leaf semi-elliptic spring fastened at its extremities to a pair of short links to allow for extension, and at the centre is bolted to a wooden cross-bar which is shaped to fit the curvature of the spring and which supports the frame and body of the vehicle. The front axle is given a drop of 1¼ in. below the centre line of the wheels in order to give additional room for deflection of the springs and thus prevent the motor shaft from striking the axle.

This view also shows a section of one of the wheels, which brings out the construction of the hub and the form or the rim and tire, the latter two being of standard section and dimensions. The construction of the seat is also indicated in the view; it will be noted that the sides are inclined outwardly and come inside the flanges of the angle iron frame at the bottom, being fastened thereto by means of screws. The steering column is shown on the right-hand side of the machine, as this side is considered in common practice to be the best for operating the machine.

Fig. 2 shows a plan view of the chassis. This shows all the operating parts in their proper relation and is probably the best drawing to work from in assembling the machine. The frame is composed of two lengths of 2 in. x 2-in. x 3-16-in. angle steel, each 84 inches long. Across the front is bolted a piece of 2-in. ash which is shaped to fit the spring; ⅜-in. carriage bolts may be used for this, and a washer should be used under the nut to prevent it from cutting into the wood. Bolted to the under side of this cross-piece in front are two longitudinal frame members of 2-in. x 2-in. ash, to which the motor and change gear case are bolted. The rear ends of these longitudinal members are supported by a 2-in. x 2-in. cross-piece, which is in turn bolted to the bottom flanges of the angle-iron frame. The clutch release and brake pedals, it will be seen, are swung on rods attached to the wood frame members. The curved connecting link which moves the sliding gear shifter and connects with the hand lever

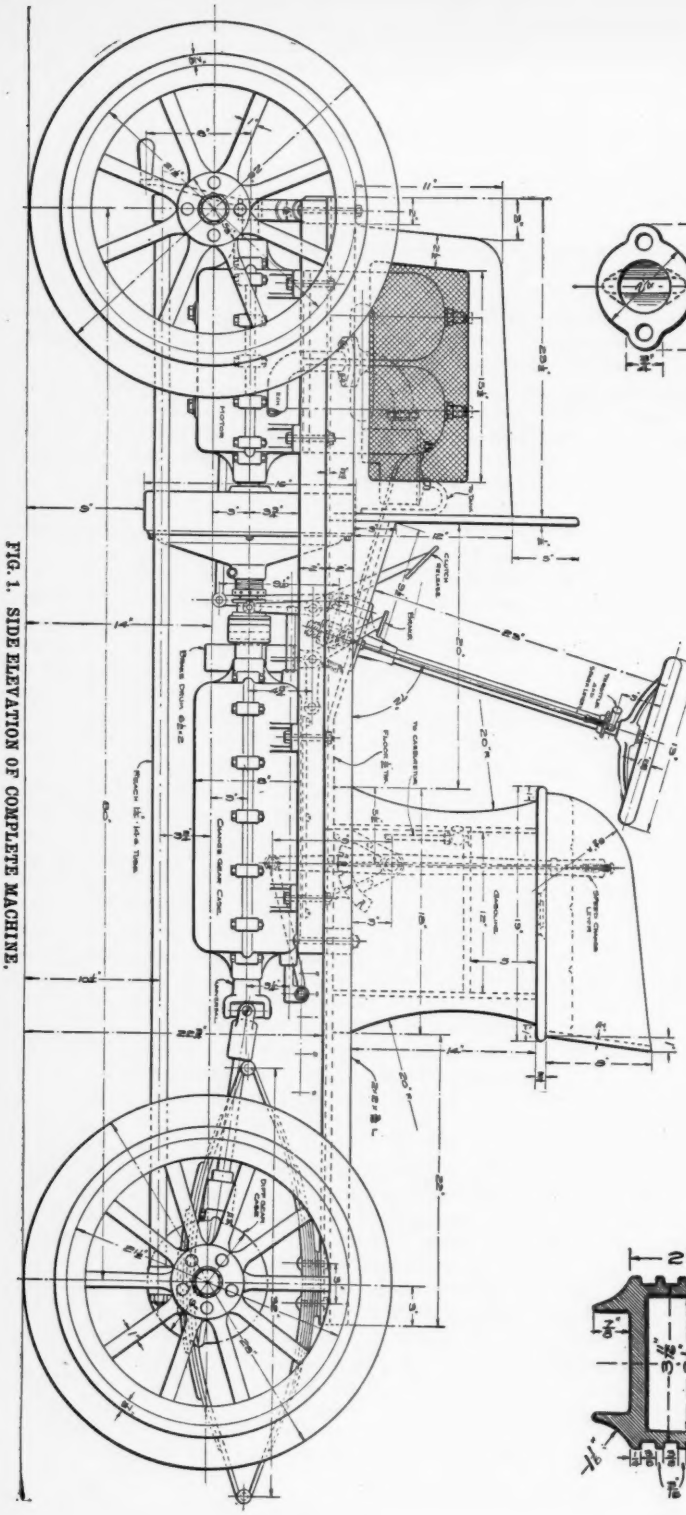


FIG. 1. SIDE ELEVATION OF COMPLETE MACHINE.

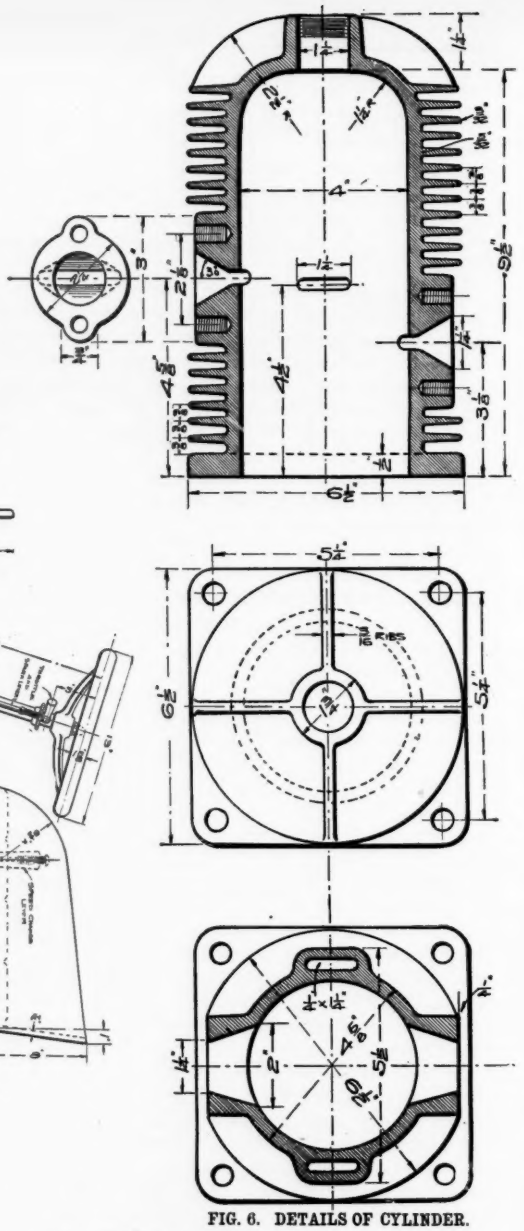


FIG. 6. DETAILS OF CYLINDER.

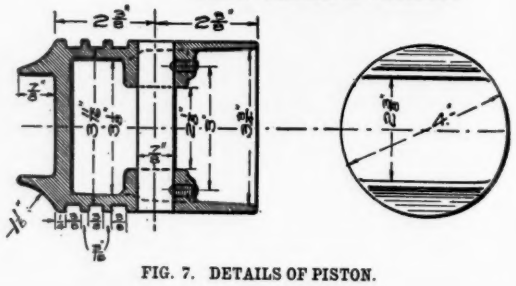


FIG. 7. DETAILS OF PISTON.

FIG. 8. DETAIL OF CONNECTING ROD.

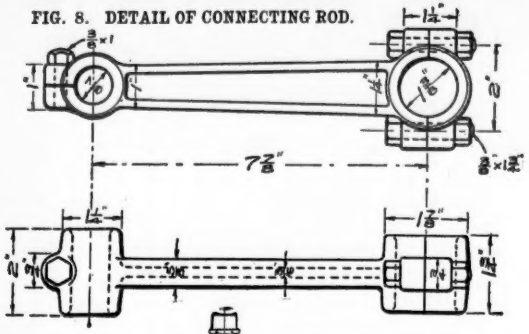


FIG. 9. DETAIL OF CRANK SHAFT.

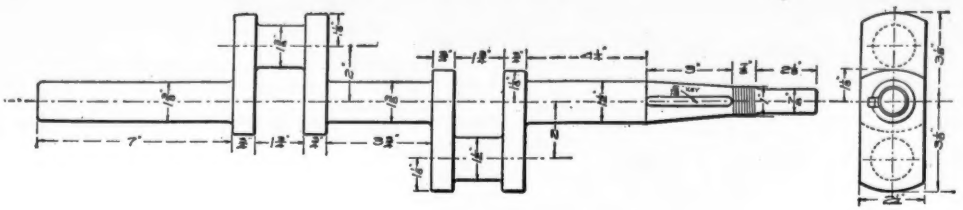
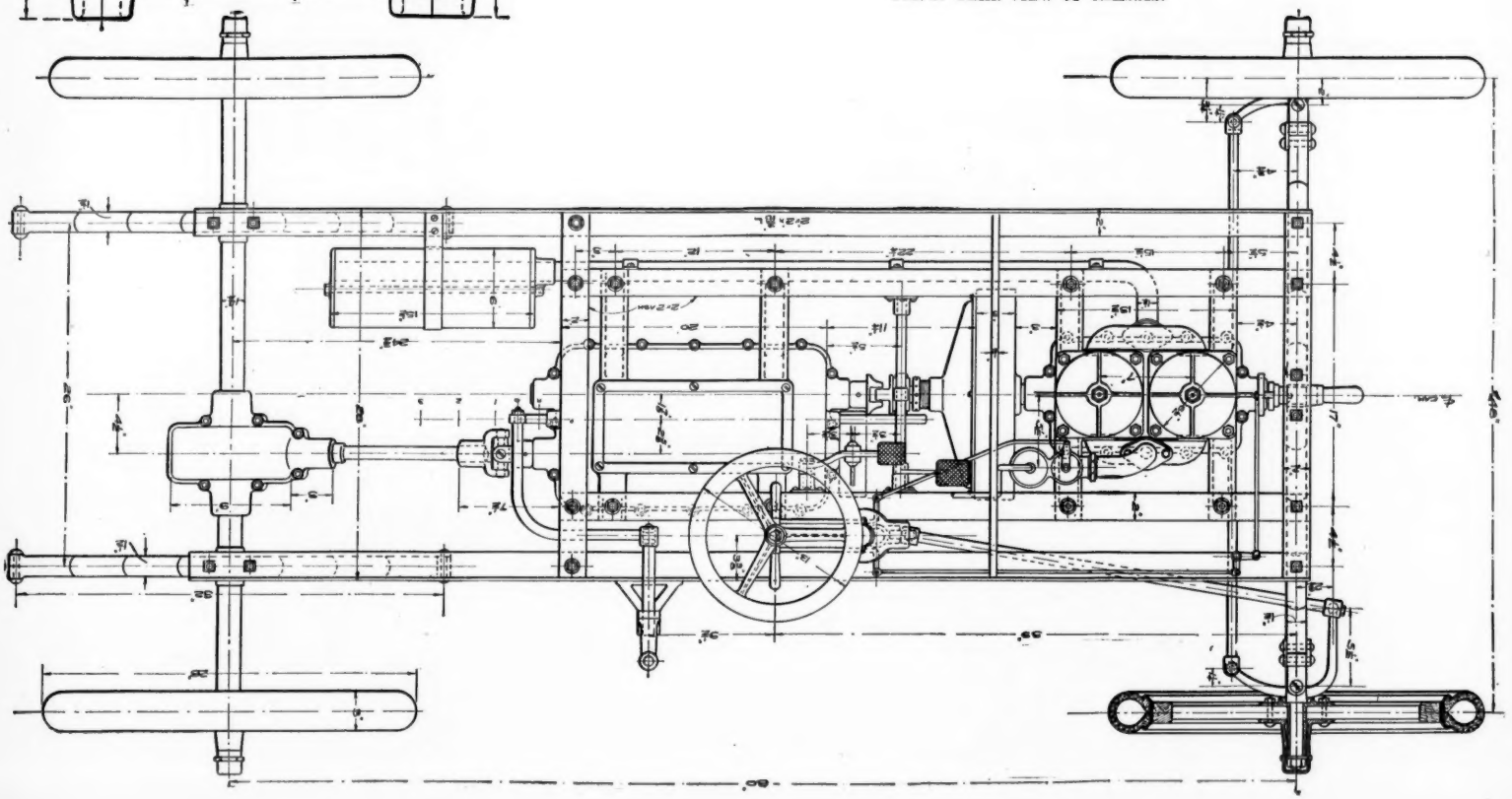
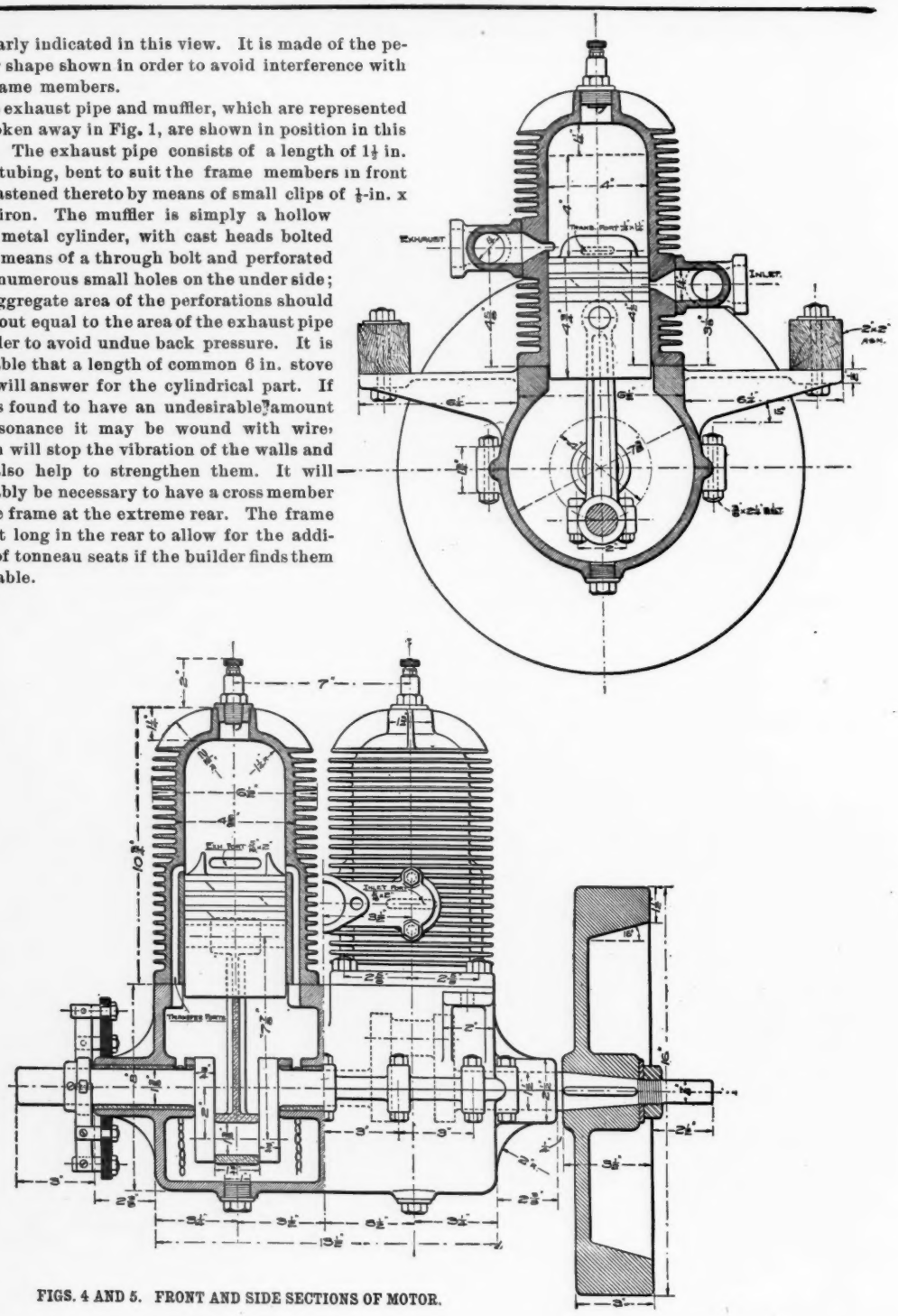


FIG. 2. PLAN VIEW OF CHASSIS.



is clearly indicated in this view. It is made of the peculiar shape shown in order to avoid interference with the frame members.

The exhaust pipe and muffler, which are represented as broken away in Fig. 1, are shown in position in this view. The exhaust pipe consists of a length of 1¼ in. steel tubing, bent to suit the frame members in front and fastened thereto by means of small clips of ⅛-in. x 1-in. iron. The muffler is simply a hollow sheet metal cylinder, with cast heads bolted in by means of a through bolt and perforated with numerous small holes on the under side; the aggregate area of the perforations should be about equal to the area of the exhaust pipe in order to avoid undue back pressure. It is probable that a length of common 6 in. stove pipe will answer for the cylindrical part. If this is found to have an undesirable amount of resonance it may be wound with wire which will stop the vibration of the walls and will also help to strengthen them. It will probably be necessary to have a cross member in the frame at the extreme rear. The frame is left long in the rear to allow for the addition of tonneau seats if the builder finds them desirable.



FIGS. 4 AND 5. FRONT AND SIDE SECTIONS OF MOTOR.

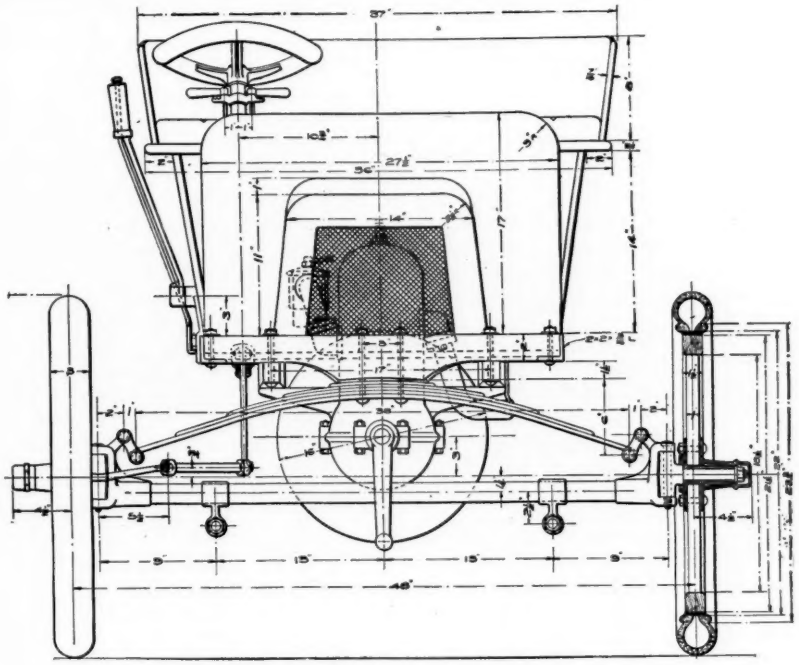


FIG. 3. END ELEVATION OF COMPLETE MACHINE.

THE MOTOR.

Fig. 4 is a front vertical section through the completed motor, which shows the location of the various ports and passages. The motor has no valves and the pistons act as valves, opening and closing the inlet and exhaust ports in the usual manner of two-cycle motors. The cylinders are 4 in. bore by 4 in. stroke. The crank case is divided into halves along a horizontal plane and is of comparatively small diameter, the fly-wheel being placed outside. Arms are cast on the top half of the case by means of which it is bolted to the frame of the car so as to afford proper clearance for the rotation of the fly-wheel. The pistons are long and have three rings for packing, which are made wider than the ports in the cylinder walls to avoid any liability to catching.

Both the inlet and the exhaust sides of the cylinder are provided with branch pipes; the connections for the main pipe in each case should be inclined to the axis of the cylinder, as shown in Fig. 5. The spark plugs are tapped into the centre of the cylinder head, where they are in a good position to ignite the charge and also accessible for inspection and cleaning when this becomes necessary.

Fig. 5 is a semi-sectional side view of the complete motor. This shows the transfer passages connecting the cylinder with the crank case and also the shape of the deflecting vanes on the piston head. The contact maker is shown on the front bearing boss and is adapted to be rotated about the cam through a certain angle, thus varying the period of ignition in the customary way. The shaft is extended somewhat on this end for fitting on the starting crank.

Fig. 6 gives details of the cylinders; these should be cast of good close-grained gray iron, and the bore should be finished as smooth and true as possible. The cylinder wall is 5-16 in. thick and is provided with 23 cast flanges, 15-16 in. high, for cooling. The vertical section shows the size and proper location of the ports, the transfer ports being two in number ½-in. x 1¼ in. opening, and the inlet and exhaust ports are each 15-16 x 2 ins.

Fig. 7 is a detail of the piston; it has three grooves turned for ⅝ in. rings. The rings should be about 1-64 in. larger than the bore of the cylinder and ⅛ in. thick. They are then cut through with a diagonal slot and should be fitted to the bore so that the ends stand a trifle apart to allow for expansion when they heat up during operation. The body of the piston should be turned about three one-thousandths small for the bore of the cylinder, and the grooves should be turned a nice fit for the rings, which can then be snapped into place and pinned to the piston so that the joints will not be required to traverse that portion of the cylinder which is broken by the ports. The wrist pin is ⅝-in. cold rolled steel and is held in position by two ½-in. set screws in the inwardly projecting bosses.

Fig. 8 is a detail of the connecting rod. This is intended to be a phosphor-bronze casting. Provision is made at both ones for taking up water. *Concl'd in Oct.*

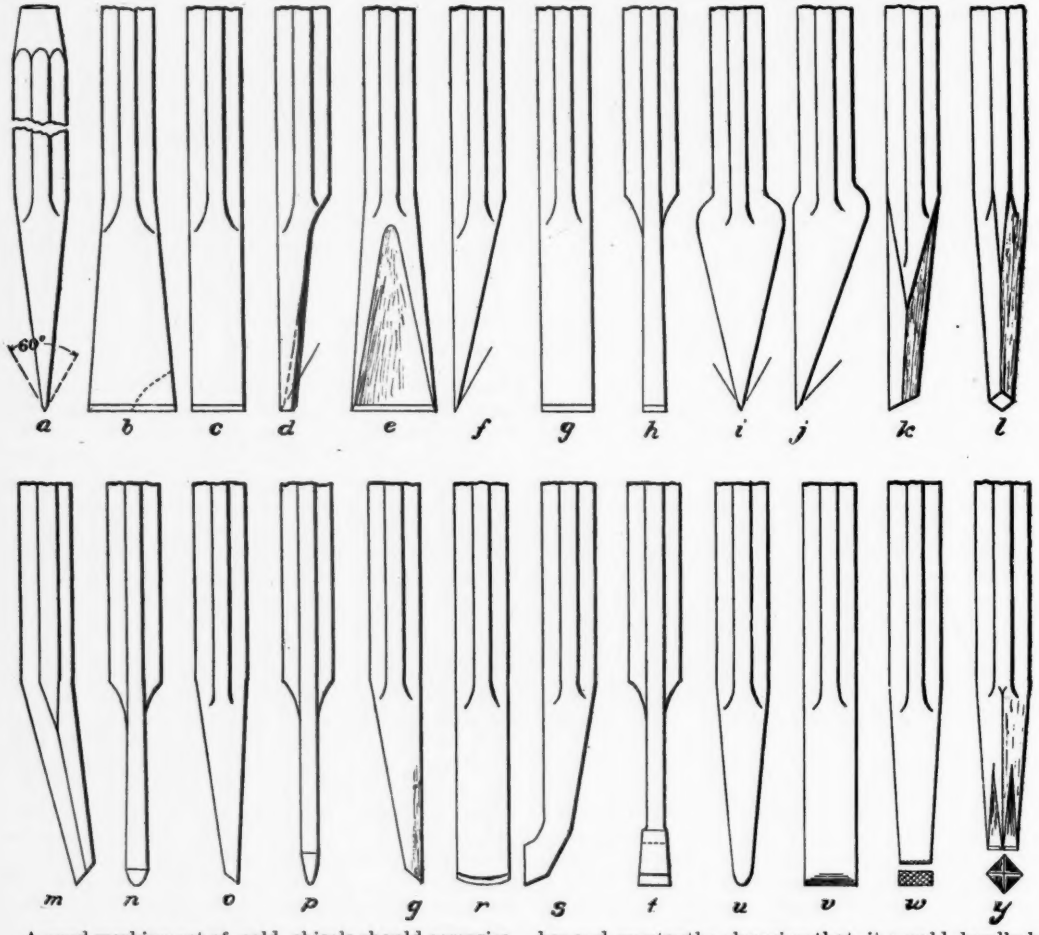
TOOL MAKING FOR AMATEURS.

ROBERT GIBSON GRISWOLD.

II. A Set of Cold Chisels.

In our first chapter we considered briefly the forging of a set of light hand tools, and in this chapter we will extend this set to that of a series of cold chisels of various sizes and shapes, such as will be most useful and convenient for the work generally pursued by the amateur.

The steel of which cold chisels are generally made is special and octagonal in shape. This octagonal shape is convenient in forming a grip for the hand to prevent twisting when struck with the hammer. When the steel is purchased at the jobbers they can give information as to the grades, which are so great in number and constantly changing that it would hardly be possible in this article to describe them. Old files make excellent chisels when properly treated, and they stand up to their work admirably.



A good working set of cold chisels should comprise quite a number, for they bear the same relation to work in metals as the carpenter's chisel does to woodwork, and for the same reason that a variety of shapes and sizes of the latter tools prove expeditious in work, so will a variety of cold chisels prove very useful in all classes of work in metals.

The character of the work determines largely the width of the cutting edge, and for this reason a number of cutting sizes will prove acceptable. When cut-

ting hard metals, such as cast iron and steel, heavy blows must generally be struck, and a narrow chisel would not stand it long without cracking on the edge, while with the softer metals, such as copper, brass and babbitt, lighter blows should be struck to prevent the metal breaking and crumbling before the chisel, this rendering the cut rough and uneven, and narrower tools are generally used for this work. But even the above rule cannot always be used for more than a guide. The thickness of the cutting edge and its angle play equally important parts, as will be spoken of later on, and the experience and judgment of the workman must be relied upon to some extent.

In Fig. 1 is shown a number of chisels shown by *a*, *b* and *c* in the form most commonly used for general work. The head should be forged down as shown so that "brooming" will to some extent be prevented. A very convenient length is five inches from head to edge, with a gradual taper from the body to the edge, as illustrated. The cutting edge is ground to about 60°, although it ranges from 45° to 75°, the blunt angles being given to the tool when used on heavy work. The flat chisels should be made in a set as follows: $\frac{3}{8}$ in. $\frac{1}{2}$ in., $\frac{5}{8}$ in., and 1 in. in width.

When the tool is forged the edge only must be hardened for about $\frac{1}{8}$ in., the metal above being left softer to withstand the shock. When the tool is left hard too far up a heavy blow will cause the thin point or edge to crack off on a line, as shown by the dotted line on *b*. Draw the temper to a light purple for steel and a dark purple for cast iron and wrought iron work.

A set of gouges as shown by *d* and *e* should be made in the following sizes, $\frac{1}{4}$ in., $\frac{3}{8}$ in., $\frac{1}{2}$ in. and $\frac{5}{8}$ in. The bevel is ground on the concave side and flat on the convex side. The gouges are used for cutting grooves and fillets.

A chisel made as in *f* and *g* is very useful and is called a side chisel. The edge of the chisel coincides with a flat side, thus enabling thin paring chips to be taken from the inside of a slot or square hole, which could not be done very well with the ordinary flat chisel. These chisels should be made in three sizes, $\frac{1}{4}$ in., $\frac{3}{8}$ in., $\frac{1}{2}$ in.

The chisels shown in *h*, *i* and *j* are known as the cape chisels and are used for cutting grooves. The point is made the width of the groove and the stock behind is made slightly thinner to give clearance. Two sizes, 3-16 in. and $\frac{1}{4}$ in. are sufficient. The shape *j* is very handy in cutting the ends of key ways square. It is practically the same as a $\frac{1}{4}$ side chisel of form *f* but it is much stronger.

The diamond point chisel *k* and *l* is used for cutting sharp corners, V grooves and lettering. Only one size is necessary, the side of the square being about $\frac{1}{8}$ in. It should not be ground to too keen a point, as it is easily broken when not well supported. When a diamond point is bent as in *m* it can be readily used on a flat surface.

Two round-nose chisels are shown at *n*, *o*, *p* and *q*. The form *n* is used for heavy work, and $\frac{1}{8}$ in. and $\frac{1}{4}$ in. are sufficient. The form *p* is lighter and is used as a drawing chisel for drawing a drill when it runs out of true. It is simply a round-nose chisel with a very long taper and small radius.

It is often necessary in fine work to remove only a very thin chip. If the ordinary flat chisel is used the corners will leave ugly cuts on the surface. The chisel is then ground slightly as in *r*, which keeps the corners in sight at all times, and very thin chips can be taken.

The form *s*, *t* is useful in cutting keyways in small holes, as the body of the chisel is kept away from the work and clean cuts can be made. The forms *u* and *v* show a caulking tool with a round nose, and at *w* is a tool with a serrated face, useful in peening out small surfaces, heads of rivets, etc., which are too thin to stand heavy peening. The face is provided with teeth by filing diagonal slots before hardening.

The tool *v* is made for splitting rivets before finally peening flat. It spreads the rivet quickly and requires only a light blow.

If the amateur provides himself with a set of tools he will be in a position to work quickly and expeditiously and the work need not suffer for want of the proper tools. Our next installment will treat of a set of lathe tools.

There are several photographic methods of making lantern slides of drawings and diagrams, of which the wet-plate process is, perhaps, the best; but recently it occurred to me to try a simple method, which has given most satisfactory results, though I do not remember to have seen it suggested elsewhere. All that is necessary is to draw or write with a hard pencil—a 6 H for choice—on ground glass squares $3\frac{1}{4}$x$3\frac{1}{4}$, of as finely ground glass as possible, then to flood the ground side of the glass with dilute Canada balsam in xyol or benzol. Cover with an ordinary lantern-slide covering glass, and bind in the usual way. The glasses must, of course, be first carefully cleaned. The result will be that the ground glass is made transparent while the pencil lines become more distinct.—*F. S. Scales.*

One result of using very short focus lenses, points out *Photography*, is that the illumination falls off rapidly as the margin of the plate is approached, a fact that may not be suspected at first, but which will make itself painfully visible as soon as a case occurs when the exposure has been full short. This is partly due to the lens. By measuring the actual proportion of the light falling upon the edges and the centre of the plate respectively, it would be found that while the difference in the quantity of the incident light is considerable, it is less than the difference in its photographic action. Comparatively little of the light that falls upon or near the centre of the plate is lost by reflection; but as the rays approach the edges, reflection becomes greater, and a very small proportion of them are available for useful work in the plate.

A BENCH GRINDER.

B. R. WICKS.

Continuing the work of machining the bench grinder, lay out the boss for the bearing of rest No. 1 central with the boss and square with the spindle bearing, and drill and ream to ½ in. diameter. The front of this boss can be faced off with a counterbore and filed and polished, but this is only done for looks.

The two bosses on the back of the spindle bearing, which are for the spindle adjusting screws, are to be laid out, drilled, counterbored and tapped. When the centre of the bosses have been located and centre punched, first drill all the way through with a 3-16 in. twist drill. Have at hand a counterbore with a ⅝ in. body and 3-16 in. pilot and counterbore down to the depth of 3-16 in. Enlarge the 3-16 in. hole to the depth of ⅜ in., with a 17-64th in. twist drill, and tap out the remainder of the 3-16th in. holes with a ¼-20 thread tap, as in section *C-D* on drawings.

The 1-16 in. slot for the take-up piece and the oil groove will be put in after the spindle, *B*, has been turned and fitted, which will come later.

The ½ in. boss on the top of the spindle bearing is to be drilled all the way through to the 9-16 in. boss with a ½ in. twist drill and enlarged with a No. 1 twist drill to the depth of ⅝ in. and tapped out with a ¼ in.-32 V thead tap for an oil cup.

There must be a ⅝ in.-16 thread tapped hole in the side of the frame, central with the thickness of the casting and exactly central with the ½ in. hole in the boss, to hold the set screw, *K*, which holds the rest No. 1 *E*, in position when the machine is in use.

Tap this hole ⅝ in.-16-thread U. S. S. and use a 5-16 in. twist drill for the tapping size. *L* is the shoe that works against the ⅝ in. flat on rest No. 1, E, to keep it in position, and also to avoid screw *K* from cutting in the ⅝ in. flat on rest No. 1, *E*. This rest is made of a piece of 19-64 in. brass rod and cut off and finished to 3-16 in. long, and placed in the ⅝ in. tapped hole when the machine is ready to put together. Screw *K* is a regular screw cut off and hardened to the figures given on the drawings.

The spindle, *B*, is made from a piece of round machine steel 6 15-16 in. long and 15-16 in. diameter in the rough, and is drilled, centred and turned up between centres to the figures given on the drawing. Both the ½ in. and 9-16 in. diameters of the spindle must be turned exactly straight, and true and smooth for good results from the machine. Allow enough on both diameters to file and polish, and fit the spindle to the 9-16 in. reamed hole in the frame, *A*, which forms the spindle bearing.

After filing the spindle, finish with fine emery cloth and oil using, as before stated, the 9-16 in. hole for a gage. The thread on the end of spindle *B* can be cut in the lathe, but if the builder has not a screw cutting lathe it can be done with a die. The die stock should be provided with a ½ in. guide to insure a straight thread.

The thread to be cut on spindle *B* is ½ in. 13-thread U. S. S. 1 ½ in. long, right hand. There is one ½ in, 13-thread semi-finished nut wanted which should be case hardened.

The two wheel flanges, *D*, are made from grey iron castings, and are to be chucked, centred, drilled, reamed and turned. The flange that fits against the 3-16x⅞ in. shoulder on spindle *B* must be bored out a little less than ½ in. the diameter of the flange end of the spindle to allow for a shrinking fit. After having bored out this flange force it on a mandrel and turn the back face that will fit against the shoulder on the spindle true. The remaining part make about 1-32 of an inch larger than the drawings. Heat this flange to a good cherry red and tap the spindle into the hole and be positive that the face of the flange and the face of the 3-16x⅞ shoulder on spindle *B* come up tight together; let it cool off (do not put it in water). When cooled put the spindle between centres and finish up the flange to the drawings and polish with emery cloth and oil. The other flange is bored so that it will slide on the spindle, and finished up in a ½ in. mandrel to the drawing. When in the chuck do not neglect to put in the recess 3-64 in. deep.

The pulley, *C*, is made from a grey iron casting. Chuck the casting and drill and ream ont to 9-16 in. diameter.; force it on a 9-16 in. mandrel and turn up to 2 in. diameter. Face the two sides of the rim, making it 1⅛ in. wide. Face up the hub ½ in. from the rim on each end, making it a total length of 1⅛ in. The pulley will now be crowned from 2 in. in the centre to 1 15-16 in. on the sides, as in the drawing; file, and polish with emery cloth and oil. There will be two ¼ in. 20-thread tapped holes to be made in the hub for the two ¼ in 20x½ in. headless set screws. *J*, which will hold the pulley *C* in position on the spindle, *B*. Lay these holes 5-16 in. from the rim and central with the diameter of the pulley, and centre punch mark and drill all the way through the rim and hub with a 3-16 in. twist drill, and tap out the 3-16 in. holes in the rim only with a 3-16 in. twist drill. Enlarge the holes in the rim only with a 17-64 in. twist drill and tap out the 3-16 in. holes in the hub with a ¼ in. 20 thread U. S. S. tap. The two set screws, *J*, are regular sizes and will not have to be made up by the builder. Two of these screws are wanted.

The rest, No. 1, *E*, is made from a piece of 11-16 in. square cold drawn steel, 4 15-16 in. long.

NOTE. The drawings and previous portion of the description appear in the AUGUST number.

Polish off the side of the steel, rub on a little blue vitriol and lay out the 7-16 in. hole for the rest, No. 2, *F*, to work in. Prick punch where the lines cross and start in with a small drill, about ⅛ in. or so, and drill all the way through. Then drill with a 28-64 in. twist drill, and finish out with a 7-16 in. lathe reamer.

The piece will now have to be centred; take it from corner to corner and drill and countersink, and between centres turn the ½ in. diameter that is to fit into the ½ in. reamed hole in the boss on the frame, *A*. This must be turned straight and smooth to the length of 4 in., leaving .002 to file and finish with emery cloth and oil. It must fit the ½ in. hole and slide in and out without any shake. The flat on the side is ⅝ in. wide 3 13-32 in. long, and can be either milled or filed. Do not fail to notice the location of this flat with the 7-16 in. hole.

The end can be finished up between centres with a round pointed tool. The ½ in. hub on the 11-16 square end is now drilled into the 7-16 in. hole with a ½ in. twist drill, and tapped out with a 5-16 in. 18-thread U. S. S. tap. The four sides can be draw filed and polished with emery cloth and oil.

The rest, No. 2*F*, is made from the same stock and machined in the same way. The only exceptions are the length, diameter, and the set screw to be used in the end. The 7-16 in. diameter of rest No. 2, *F*, fits in the 7-16 in. hole in rest No. 1, *E*, and must be a good sliding fit without any shake. The 11-16 in. square end is drilled with a 3-16 in. twist drill and tapped out with a ¼ in. 20-thread, U. S. S. tap.

There will be one of each of the screws shown on the lower right-hand corner of the drawing. These are to fit the ends of rests No. 1, *E*, and No. 2, *F*, and are made from regular set screws cut off to the figures given on the drawings, and the heads drilled in and hardened. The drawings show the position of these screws when the machine is assembled.

The tool rest, *H*, is made from a grey iron casting and is laid out by the 9-16 in. boss on the bottom of the castings, and drilled and reamed out to 5-16 in. diameter, forced on a short mandrel and faced up ⅝ in. thick. The under part does not need to be machined. The 5-16 in. hole is slightly countersunk so that the tool rest spindle, *C*, can be riveted in. The tool rest spindle, *G*, is made from a piece of ⅝ x 2 7-16 in. Bessemer steel. One end must be turned down to drive in the 5-16 in. hole in tool rest, H, ahd be riveted, draw filed and polished on the top and edges.

The remaining work to bedone will be to put in the oil graove, saw the bearing through with a 1-16 in. saw, make the spindle adjusting piece, paint and assemble. The oil groove in this case can be filed in with a ½ in. rat tailed file, starting in on one end and then turning the piece end for end until the groove is made. To saw out the 1-16 in. slot a milling machine will have to be used. Set the casting in the vise by the two finished ends of the spindle bearing and set the 1-16 mill exactly central with the 9-16 in. hole and central with the thickness of the two bosses, as in section *C-D* on the drawing, slowly feed in the saw and cut the 1-16 in. slot all the way through. Remove from the vise and with a fine half round file, file out the burr left by saw.

The spindle adjusting piece is not shown on the drawings. It is made from sheet brass 1-16 in. thick. Take the piece of brass, file off any burr that may be on it and slide it into the slot within 1-32 in. of the spindle on each end, mark around the casting and locate the two 17-64 in. holes with a sharp scratch. Now remove and drill the two holes with a 17-64 in. drill, file down to the lines and the piece is done. Make the length of the piece about 2 15-32 in. long. The adjusting piece can now be replaced, and the two spindle adjusting screws which have been made and hardened screwed in their places in the bosses.

The spindle, *B*, can now be placed in position in the bearing. Screw down the two adjusting screws on both ends until the spindle will turn freely in the bearing without any shake. If the adjusting piece proves to be too thick to get the proper adjustment it will have to be taken out and draw filed until the proper adjustment can be obtained. The only remaining work is to assemble the various parts and paint or enamel the machines. As all the parts are named and the bearings clearly show how and where these parts are to go, there should be no trouble in assembling and putting the machine in operation.

ABOUT PATENTS.

When to be Obtained and How Developed.

Whether because of the stories of immense fortunes to be made through patents, or the natural prodnct of the fertile ingenuity of the people of this country, it certainly is a fact that an immense number of patents are yearly granted by the patent office at Washington. It needs but a hasty perusal, however, of that bulky weekly volume, the Patent Office Gazette, to show to to the experienced and educated mind that large numbers of these so-called inventions are destined to quickly sink into oblivion, leaving behind them no other record than that above mentioned, of the time and money expended, and the probably accompanying dreams of future fortunes forever blasted. Because it is certainly true that most of the patents are secured by inventors actuated by a desire to profit quickly and in a large measure from the devices their minds have created. It is also undoubtedly true that many of these inventors have devoted much time and money badly needed for family necessities to perfecting their inventions, which were bound from their nature to have little or no commercial value, and so procure no return for the sacrifices made.

While in no wise wishing to discourage meritorious invention, it is hoped that what is here stated will be helpful to readers and prevent those of an inventive turn from repeating the mistakes and suffering the losses which are, unfortunately, so frequent at the present time.

A few words about inventions in general. Excluding those which are secured by paid employes of manufacturing concerns to protect or improve the control by such concern of some process or machine already owned by them, the majority of patents otherwise granted are obtained with the expectation that the inventor will secure direct and liberal financial returns therefrom.

Under what conditions is this expectation likely to be realized? Among these conditions may be mentioned that the article be one for which sufficient demand already exists, or a reasonable certainty that such a demand can be created, to warrant its manufacture. This is often a most difficult matter to decide, and expert opinion may vary widely. Not many years ago an inventor offered to sell a manufacturer the patent for a small pin for $750, but the offer was declined. Within a year the same manufacturer had paid in royalties over $1100 for the right to use the pin, which was not an exclusive right, or considerably more than the sole ownership would have cost.

Another important condition is that the cost of manufacture of an article shall be within the limit which will permit of its being sold at a satisfactory profit, or permit of its being sold in competition with existing devices. The non-refillable bottle is a good illustration of the above condition. It has been pretty generally reported that a fortune awaits the inventor of a successful non-refillable bottle. Perhaps this is so, but whether it is or not, it certainly is a fact that of the hundreds of patents granted on devices for this purpose, few of them could be manufectured at a cost that would permit of their being generally used, and many of them would be so expensive as to immediately settle the question of their use in the negative. If the inventor had but consulted a competent business man or manufacturer before going to any expense for a patent, the impracticability of the invention would have been made clear to him.

Admitting that there is some merit to an invention, there still exists the question: Can a sufficient sale be developed, without too much expense, to promise a satisfactory profit. In this class are many devices intended for use on street and steam railways. At once is met the great difficulty of securing a trial by a railway of sufficient size so that approval brings commercial standing. Influential friends may be of some value in securing a trial, but more generally this counts for but little. The officials of the large systems are importuned continually by inventors, and a device must possess evident merit to secure a proper trial. A good way to give an invention of this class standing is to interest a small road to allow a trial to be made, and if satisfactory results follow, the larger ones can then be more easily prevailed upon to give trials. But no railroad, large or small, will expend money on an untried or unnecessary device. By unnecessary is meant anything which they can get along without, unless a sufficient saving is effected to make its purchase and use economical. The engineer of one large railway always tells inventors or promoters of untried devices that his road is willing to let others do the experimenting, and they will pay the increased price for the perfected article when they find they have got to have it.

From this brief presentation, it should be evident that the commercial conditions are quite as important as the mechanical ones, and should receive quite as thorough an investigation before time or money is invested in inventive work. If this idea was more generally followed, many patent agents would be obliged to seek other fields of labor, without any great loss to the public, and with considerable saving to many whose visionary ideas or impracticable friends have led them to secure one more foolish patent.

Assuming that a device has merit, is original, and that a promising field awaits the granting of the patent, the value of a patent then depends to quite an extent upon the broadness of the claims. A patent attorney who is working for the best interests of his client, endeavors to have the claims made as comprehensive as possible, many times expecting the first application to be returned for revision or the elimination of some one claim or more, clinging persistently to as much as possible, and conceding slowly only what is necessary to finally secure the patent. Of course such services are expensive and not given by "job lot" firms who obtain patents on the first application simply because the claims are so restricted that no conflicts are likely or desired. Such patents have little or no value for that very reason. An invention must indeed be novel if it does not in some way touch upon the ground covered by another, and skill and care are needed to preserve a strong and valuable patent.

In conclusion, it may be stated that inventors are not usually very good business managers and had best leave the business end to others. The fear of being tricked out of just returns is an ever present one with inventors, but considering the number of failures made by those who attempt to finance their own inventions, the chances of success are decidedly in favor of those who are wise enough to secure the services of a reliable and competent business man; the combined team of inventive and commercial ability being a strong one and likely to achieve success if success be possible.

Many large manufacturing concerns will not today consider the purchase of an invention unless a price so low as to make the risk of loss a small one. They will, however, give careful attention to anything with merit on a royalty basis, and to most inventors this is by far the best arrangement possible. The business skill, established trade and reputation of the firm are immediately made avallable to place the invention before the trade, and sales are then being made and profits realized before any inventor, thus unaided, could have got properly started By this arrangement the inventor shows his own faith in his invention, and in the majority of cases will secure as large or larger returns than when managing the business himself, because of the better facilities for developing the invention.

JUNIOR DEPARTMENT

For the Instruction and Information of Younger Readers.

ELEMENTARY MECHANICS.

J. A. COOLIDGE.

VIII. Buoyancy.

That bodies heavier than water sink, and if lighter than water float, is a fact so well known as to make any such statement unnecessary. Yet the relation these bodies bear to water and other liquids and the cause of a body's sinking in one liquid and not in another afford us opportunity for valuable experiment and additional knowledge.

If a stone or other body falls through the air or sinks in water, it is because a downward force called gravity pulls it, and every body will move downward, *i. e.*, towards the earth's centre, until something prevents further motion or, better, until the force pushing upward balances the force downward. The downward force we call the weight of the body. In every floating body we call the force holding it up, the buoyancy. A few experiments will teach us some interesting facts about buoyancy.

Let us make first two blocks 2x3x3 in. and a little box of ¼ in. stock that will just hold one of these blocks. See Fig. 23. The box and the block may be of pine and should be coated thoroughly with melted paraffine, which may be obtained from a common candle. The wax will make them waterproof. A large glass jar 10 in. deep and 6 in. in diameter will be a great convenience, although a deep pan or pail will answer.

EXPERIMENT XIX.

Take the box and block to a grocer's or provision store and weigh them as accurately as the scales will allow. If you know some druggist who would help you weigh them to 1-10 oz., the experiment would be more successful. Fill the box with cool water and weigh again. The box and the blocks, if accurate in measurement, contain just 18 cubic inches in volume. By dividing the weight of the block by 18 you will have the weight of 1 cubic inch of wood. This will be the density of this wood. From the weight of the box filled with water subtract the weight of the empty box and divide this figure by 18 and you will find the density of water, which is about .58 of an ounce per cubic inch. Commonly 62.5 pounds is allowed as the weight of a cubic foot of water.

EXPERIMENT XX.

Float the box in the jar of water and measure carefully the depth that it sinks in water. If one corner sinks more than another, all four corners should be measured. Calculate the volume, ABCD, under water. See Fig. 24. This will be the amount of water displaced. Find the weight of this water, allowing .58 oz. for every cubic inch. Does it not equal the weight of the box? It should, for every floating body displaces its own weight.

EXPERIMENT XXI.

Take a tin vegetable can, measure its diameter. Calculate the size of the bottom by multiplying radius x radius x 3 1-7. Put some sand in the bottom and make it float vertically. Measure the depth under water.

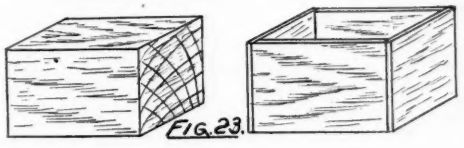


FIG. 23.

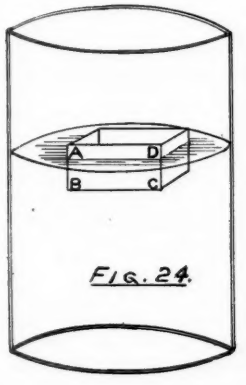


FIG. 24.

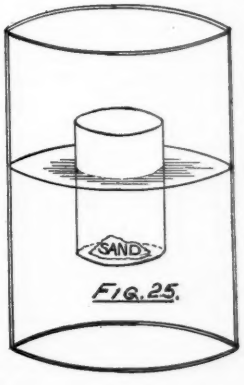


FIG. 25.

The volume of water displaced will be the area of the bottom multiplied by the depth under water. Find the weight of this number of cubic inches of water by multiplying this volume by .58 oz. Weigh the can with the sand in it. Of course you know that the hollow can floats because, although of heavier material than water, it displaces its own weight, and by sinking deeper in the water it would still float and hold more sand inside. See Fig. 25.

These two experiments show how a wooden ship, and even one made of steel and iron, floats while holding an immense cargo. A vessel made of iron or steel, although of material seven times as heavy as water, has large airtight compartments, so that buoyancy is sufficient to float ship, passengers, cargo, and many other things. I have in my hands the description of one of the great ocean steamers, not the largest, yet in itself a floating city. Try with me to get some concep-

tion of her size. She is 580 ft. long. Pace off 200 of your own steps and see how far you have gone and you will have some idea of the length. It would take you two minutes to walk from bow to stern. In a town or city where lots have 50 feet frontage this vessel would, if placed in the street, pass by eleven houses. She is 62 feet wide and would fill many an ordinary street from side to side, touching the houses on both sides. She is 45 feet deep. We could stand in the third story window of our houses and look up to the deck of this boat, or step from the deck to the roof of a five storied building. She weighs 13,000 tons empty, and will carry 12,000 tons of cargo. She carries about 800 single loads of coal just for her own use and, although floating in an ocean of water, carries over 2000 tons of fresh water on board. Over 1,000 people find every accommodation for a long cruise, as many as are found in many small towns, and all are comfortably housed and fed. Every modern convenience, electric lights, baths, ice, fire alarm and apparatus is found on board. She makes her own ice and carries apparatus for evaporating fresh water from salt, enough to make 40 tons every day. Immense engines and shafting over 200 feet long and 16 inches in diameter, of 9,000 horse power, drive this immense floating palace through the water. Can you not see how important it is to know about the buoyant effect of water in order to provide for floating such a vessel?

The effect of salt water as compared with fresh in its buoyancy, can be studied with profit.

EXPERIMENT XXII.

Take two jars or pails. Fill them both with fresh water. Now take an egg, hold it in the water and let go. It will sink. In one of the jars put a handful of salt and stir. If the egg still remains on the bottom, put in more salt. While this experiment is going on take one block and float it in fresh water, then in salt. In each case notice the depth to which it sinks. With a good deal of salt in the water the egg may be made to float, and the block floats with much less under water than before. In an ocean of salt water a vessel sinks less deep than in fresh because the displaced water is heavier and, therefore, the buoyancy is greater. We see, then, that heavy liquids are more buoyant than lighter ones. In mercury, the heaviest liquid, solid iron, or even lead, will float readily.

HOW BOYS CAN EARN MONEY.

RAY L. SOUTHWORTH.

To help increase the income of the workers who read AMATEUR WORK by means of some little business that will be agreeable and dignified, the following are offered. All have been actually employed, and therefore are possible for these conditions. Although there are two conditions named and the suggestions are placed where it seems the most practical, yet it may be found very useful in some instances to use several in the same locality.

There are some important requisites that a boy must possess if he will be successful. It has been found that where there was hustle with carefulness, honesty and integrity, a reputation was soon made that guaranteed success in the following, and in later life as well.

An individual will discover that there are some things he can do very easily and excel others, and when there is aptness in this way for one thing, it were well to specialize in it.

Business without capital.

a. There is the possibility of acting as errand boy before and after school for ladies of the neighborhood, offices and markets.

b. Parcel delivery by foot, bicycle, or wagon should a horse be at one's disposal.

c. Acting as usher at various public gatherings.

d. If in a large manufacturing centre, buy tools and supplies for workers living outside; that is, a mail order business, charging a small commission.

o. Have pieces, like small motor castings, engines, etc., cast by the thousand, then advertise and sell.

f. Taking some quantity of ice and spring water from the large companies and delivering to immediate neigborhood, and receieve a commission on amount handled for the company.

g. Collect eggs, butter, poultry, etc., from farmers and sell to regular customers every Saturday at the increased price that guaranteed, good, fresh produce brings.

h. Small sign and notice printing and painting, specializing in store window-display signs. Have a set of good samples to show as one goes about to solicit patronage.

i. Take an agency for a laundry; collect and deliver, taking commission.

j. Clerking and helping in stores on Saturdays.

b. Book-keeping for small concerns.

l. Private tutoring to boy friends.

m. Care of furnaces and other chores, having six or more, and take by written contract.

n. One may have a friend who has a tin shop in which ornamental articles, as lamp shades, lanterns, etc., may be made, and then sell these in the large department stores; likewise the same may be done in making and selling fancy boxes of wood.

o. Coasters may be made that can be used for sleighing parties when a horse is attached.

p. It is possible to clean and press clothing with trouser-presser as a specialty. Can use mother's ironing outfit and exchange work with her for its use.

q. Some boys will find themselves quite successful at collecting bills.

Business with a small capital.

a. Build furniture to sell. First there is a possibility of making such pieces as are given in AMATEUR WORK, then again, making pieces to order, with the stain and finish to suit the taste of the buyer.

b. Start a news stand. Be sure to have a complete

and attractive display of all good publications.

c. At pleasure resorts there is opportunity for rental of tents, land and cabins.

d. In many instances there is opportunity to do type-setting of various kinds.

e. Establish a tinware and small repairing shop.

f. Raising blooded chickens to sell; also eggs.

g. Procuring subscriptions to papers and periodicals.

h. Selling some good novelty for about ten cents, such that the seller will not be ashamed to meet the buyer on the day following the sale.

i. Build and rent a boat, or row for fishing parties.

j. Buy mechanical and other periodicals and sublet for five days at two or three cents per day per paper to boy friends.

k. Prepare stock to size for pieces in wood, as given in the AMATEUR WORK, then advertise and sell these so buyer can finish and set up with little work.

l. Mix pigments in dry state for stains, so that for a certain stain it will only be necessary for the buyer to add the liquid before using.

m. Some boys have discovered that they can do very satisfactory work in designing and using the sewing machine to make ties, mufflers, fancy vests, etc., and sell to boy friends who are always ready to purchase a neat and attractive piece of wearing apparel.

LANTERN SLIDES FROM PRINTS.

Making lantern slides from book illustrations without a camera is possible by a method described in *Camera Craft* by B. Roloff. A half-tone illustration from a popular magazine may be found to have its back covered with printed matter. Now it is desired to use that illustration as a negative, and the sensitive plate as a positive, resembling the method of a bromide paper. By printing through the illustration as it is, the printed matter on the back would also show; so the first thing, then, is to get rid of this. The illustration is cut out, placed face downwards on a piece of ground glass, and the back is wetted slightly by means of a wad of cotton or a sponge until the dampness shows signs of coming through. It must not be made thoroughly wet, as that might injure the ink on the face. With a piece of medium emery paper gently rub the moistened surface until all the ink is off the back. This will leave a roughened surface which can be improved by using a finer grade of emery paper.

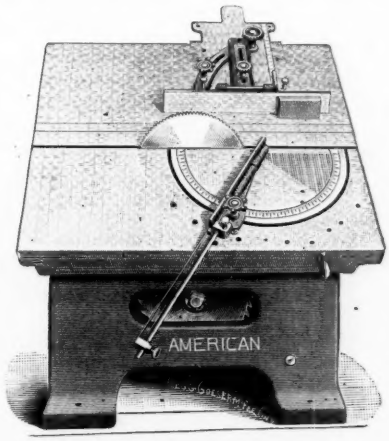
Now dissolve 3 oz. of gelatine in 1 oz. of water, add 1 oz. of albumen, and then a few drops of salicylic acid to act as a preservative. The albumen may be made by beating up the whites of eggs. This thick solution is lightly smeared on to the roughened surface of the paper, care being taken not to leave streaks, and for this reason either a soft wad of cotton or a small camel-hair brush should be used. The result is a new surface on the back of the print, smooth and finished as before. Now the print is ready for making the negative, though should it not be sufficiently translucent, apply vaseline, Canada balsam, or a mixture of three parts of paraffin wax and 1 part of naptha, gently heated until dissolved; rub this in until none remains on the surface, and if the wax solution is employed, the paper should then be slightly heated, placed between blotting papers for a few hours, and rubbed again with a clean cloth to take off the surface oil. The illustration may then be placed in a reghlar printing frame, which is to be taken into a dark-room and a sensitive plate of proper size placed over it, film side down, as in making a print. The exposure may be determined easily. One second a foot or so from a Welsbach burner is usually found to be sufficient for the least transparent illustration. The plate may be developed in the usual way, or a special developer giving great vigor may be used.

TRADE NOTES.

CLEMENT UNIVERSAL SAW BENCE.

The following description of the Clement universal saw bench, manufactured by the American Woodworking Machinery Co., 136 Liberty Street, New York, will be of interest to manual training teachers, pattern makers and others.

This is the heaviest, most convenient and most accurately fitted tool of the kind now made. The box



frame is cast in one piece, has three points of support on the floor, and a base surface of 33x39 in; it is thus massive and rigid and cannot be sprung or strained by any ordinary possibility. The arbor yoke is extra long and carries two cast steel arbors 1¼ in. diameter with long self-oiling boxes and pulley between. The yoke swings on gudgeons on both sides of the saw line, and the main one is 7 in. diameter and has side bearing shoulders 9½ in diameter with a suitable adjustment for wear; the circular adjustment is by means of

a heavy worm wheel and a double pitch worm with adjustments for wear both longitudinally and laterally; thus there need be no time wasted in changing saws, and no lost motion in the connections.

The table is 45 in. long and 39 in. wide, divided into two sections; the moveable left hand one is 17 in. wide and the right hand one 22 in. wide. The left hand section moves on non-friction rolls and is guined by a planed and scraped way, insuring an accurate cut, and by means of an intermediate frame or spider it can be drawn away from the main section 2½ in. to admit dado heads or special cutters. The entire table, which is unusually heavy and strongly ribbed, can be tilted to 45° or any intermediate point, by means of a screw and radius arm, all bearings of which can be adjusted for wear. An accurately graduated arc and an index are provided on the front of the machine, and a stop at the rear of the frame directly in line of the radius arm holds the table, when down horizontally, square with the saws.

The rippling gauge moves over the entire width of the main table, takes from 0 to 24 in. wide, and the fence tilts to 45° from the vertical. The entire guage also swings on one of the retaining pins to a horizontal angle with the saw for cutting core boxes, etc. In addition to the position of adjustmeut by means of the taper pins, there is a micrometer adjustment of 8 in. by means of a steel rack and pinion cut from the solid, making the movement quick and accurate. The gauge may be transferred to the left hand table when required, and there is on its face a detachable block which can be used as a cut-off stop.

The cut-off or mitre gauge is swiveled on the rolling table section, and is accurately stopped by a taper pin at all the principal angles, in addition to which there is a complete half-circle protractor let into the table; to this is added a novel cross graduated sector by which angles corresponding to any required dimension of work can be cut without previonsly determining the angle, saving much time and calculation; this is a valuable addition, and is found on no other tool of this kind. For long work a steel rod is furnished with an adjustable end stop which recedes for cropping off ends and can be used down to 2 in. in length and up to 5 ft. 3 in. The right hand table has a rule graduated to inches and eighths for cutting off. A supplementary cut-off guage is fitted to the right hand table, consisting of a long tongue moving freely in a slot, to which is attached a swiveling head or fence graduated to 45° both ways and arranged to be connected when desired with the main cut-off guage by a yoke or arch which passes over the saw and thus makes a long, well-sup ported guage for large work. When the supplementary cut-off gauge is not in use the fence can be detached from the tongue, and the latter turned over in its slot so as to make a flush surface on the table, as indicated in the engraving.

A special sleeve is provided for the attachment of dado heads up to 2 in. thick; this sleeve takes the place of the nut and loose collar on the saw arbor; heads thicker than 2 in, at the eye will need to be recessed to receive the nut. An idler jack is supplied carrying two 7 in. pulleys running on steel shaft with bronze bushes arranged for self-oiling. This jack is so arranged that the countershaft on the floor at the rear of the machine or below the floor at a distance from the machine. When it is desired to place the countershaft directly under the centre of the arbor yoke the idler jack will not be needed and a fair allowance will be made for it.

The countershaft is turned steel, running in self-oiling, self-adjusting and adjustable boxes. The loose pulley is self-oiling and is 1 in. smaller in diameter than the tight pulley, with a "jump" flange for starting easily. The tight pulley is 10 in. diameter, 6½ in. face, and the speed should be 650 r. p. m. The driving pulley is 28 in. diameter and 5½ in. face. giving the saw arbors about 2,900 r. p. m. The driving pulley is 18 in. diameter and 5½ in. The belt shifter is so arranged that the operator can stop by pressing a pedal lever, but when the counter is placed below the floor a hand lever is supplied. With each machine is furnished a countershaft with a pedal or a lever shifter; two 16 in. saws, cut-off gauge with extension rod, small mitre gauge in main table and connecting yoke for the two, splitting gauge and necessary wrenches.

The accompanying illustration shows the latest creation in an adjustable jawed end nipper manufactured and sold by The Utica Drop Forge and Tool Co., and

Smith & Hemenway Co., 296 Broadway, New York City. These are made in sizes 8, 10 and 12 inch. The frames are made of a high grade of cast steel and the jaws of the finest tool steel. Prices and illustrations will be furnished to the trade on application.

To make the Amateur lathe more widely known, we will send one of the No. 1 size, 24 inch bed, to anyone sending $7.50. Mention in order whether round or flat belt is wanted. This is an exceptional opportunity for anyone desiring a small lathe.